



Geotechnical Foundation Report

Madera Canyon Road, Florida Canyon Wash and Medium Wash Bridges

Florida Canyon Wash

ADOT Project No.: TO540 01C

Federal Project No.: PPM-0(273)D

Pima County Project No.: 24041PJ

Medium Wash

ADOT Project No.: T0541 01C

Federal Project No.: PPM-0(274)D

Pima County Project No.: 24043PJ

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INTRODUCTION

This Geotechnical Foundation Report presents information and recommendations for the replacement of two bridges on Madera Canyon Road crossing the Florida Canyon Wash and Medium Wash. Selected plan sheets for the proposed improvements for both bridges are provided in Appendix A.

The geotechnical field investigation and soils laboratory testing for the project were performed by Terracon Consultants (Terracon) for HDR. Details of the subsurface investigation (drilling and sampling, and laboratory testing) are included in the Geotechnical Data Report prepared by Terracon (the Terracon Report) (Terracon Project No. 63245064, dated November 18, 2025). The Terracon Report is provided in Appendix B.

Pavement design for the project was performed by Solis Engineering; pavement structural sections and recommendations are provided in a separate report.

GEOTECHNICAL INVESTIGATION

The field investigation for the project was performed by Terracon on September 8 to 15, 2025. The investigation included a total of twelve borings at the two bridges and the roadway approaches to the bridges. Two deep borings were performed at each bridge location to depths of 60 to 76 feet below existing grade (bgs). Two roadway borings were also performed at each bridge approach to a depth of 5 feet bgs.

The roadway borings were advanced with a truck-mounted CME-75 drill rig with 7-inch outside diameter hollow-stem auger. The box culvert borings were advanced with a track-mounted Terra sonic drill rig with 4-inch outside diameter casing.

Approximate as-drilled locations of the borings are shown on the Exploration Plan in the Terracon Report in Appendix B.

LABORATORY TESTING

Laboratory tests were performed by the Terracon laboratory on selected soil samples in accordance with sample selection and test assignments made by HDR. The entirety of the test results are presented in the Terracon Report; selected test results are summarized below and discussed herein.

Gradation tests (sieve analyses) were performed on standard penetration test (SPT) split-tube samples, modified California (brass ring lined) split-barrel samples, and bulk samples of drill cuttings recovered from the borings. Gradation test results indicated broad ranges of percent soil

finer (percent passing the No. 200 sieve by weight) from 4 to 63 percent, percent sand from 33 to 78 percent, and percent gravel from 0 to 69 percent. The Atterberg limits test results in general indicated non-plastic to medium plasticity soils with plasticity index values ranging from 0 to 16.

In-situ moisture contents of soil samples ranged from 1 to 13 percent, and in-situ dry densities of soil samples ranged from about 98 to 131 pounds per cubic foot (pcf).

Direct shear testing was performed on three relatively undisturbed modified California samples recovered from depths ranging from 7.5 feet to 20 feet bgs. The friction angle at peak shear stress ranged from 25 to 45 degrees. The cohesion at peak shear stress ranged from 653 to 1,274 pounds per square foot (psf).

Corrosion testing was performed on four selected samples as described in the Terracon Report in Appendix B. The tested pH ranged from 6.3 to 8.0 and the laboratory minimum resistivity ranged from 2,700 to 27,000 ohm-centimeters. Soluble chlorides concentration of tested soil samples ranged from 10 to 30 parts per million (ppm). Soluble sulfates concentrations of tested soil samples ranged from 9 to 102 ppm. Additional discussion regarding the potential for corrosion for the site soils is included later in this report.

SUBSURFACE CONDITIONS

The soils encountered in the subsurface investigation consisted of medium dense to very dense sand and gravel soils with varying amounts of silt and clay. The predominant USCS soil classification is Clayey Sand (SC), with smaller amounts of Silty Clayey Sand (SC-SM) and Silty Sand (SM). A layer of hard Sandy Lean Clay (CL) was encountered between depths of 17 feet to 29 feet at boring MB2. The subsurface conditions were generally similar at each crossing location, with the exception of slightly lower SPT N-values in the top 12.5 feet bgs at Medium Wash.

Geotechnical Design Profile

The spread footing design recommendations are based on the borings performed at each bridge location. The design profiles for Florida Canyon Wash and Medium Wash bridges and wingwalls are provided in Tables 5 and 6, respectively.

Corrosion Considerations

Laboratory testing of eight soil samples indicated a pH of 6.3 to 8.0 and a laboratory minimum resistivity of 2,700 to 27,000 ohm-centimeters. These results indicate that there are no restrictions

for steel pipe culverts based on Figure 203.04-5 of the ADOT Materials Preliminary Engineering and Design Manual (ADOT, 1989).

Based on the ranges of concentration of soluble sulfates and soluble chlorides at less than 350 ppm, Type I or II Portland cement can be used based on the AWWA manual for External Corrosion and Corrosion Control of Buried Water Mains (AWWA, 2004).

The concentrations of soluble sulfates indicate that the subsurface soils represent a Class S0 exposure to sulfate attack on concrete in contact with the soil (water soluble sulfate in soil is less than 0.1 percent by mass) based on the American Concrete Institute (ACI) 318-19 Table 19.3.1.1 (ACI, 2019). Therefore, in accordance with ACI Building Code 318-14 no special provisions for selection of cement type are required.

GROUNDWATER CONDITIONS

Groundwater was not encountered during the subsurface investigation. A description of the groundwater conditions in the site area is provided in the Terracon Report in Appendix B. Groundwater is anticipated to be located at a depth well below the depth of the proposed spread footing excavations.

SITE SEISMICITY

The project seismic AASHTO Load and Resistance Factor Design (LRFD) criteria were determined in accordance with Section 3.10 of the AASHTO LRFD Bridge Design Specifications (American Association of State Highway and Transportation Officials [AASHTO], 2012). The horizontal design acceleration is defined as having a 7% chance of exceedance during a 75-year recurrence interval. Based on the subsurface conditions encountered (average SPT N-Values greater than 50 blows per foot) in the borings, Site Class C was used for the analysis. The probabilistic horizontal spectral acceleration values for the designated return period and corresponding peak horizontal ground acceleration (PGA) were obtained from the U.S. Geological Survey (USGS) seismic hazards program website (USGS, 2009). The resulting seismic design values are presented in Tables 1 through 3.

Table 1: Seismic Design Parameters

Site Class	Seismic Zone	Seismic Design Parameter	Spectral Acceleration Value [g]
C	1	Peak Ground Acceleration (PGA)	0.069
		Short Period Acceleration (S_s)	0.158
		Long Period Acceleration (S_1)	0.046

NOTES

Latitude 31.785725°, Longitude -110.885675°

g = gravitational acceleration

Table 2: Seismic Site Factors

Seismic Site Factor	Value
PGA Site Factor, F_{pga}	1.2
Short Period Acceleration Site Factor (F_a)	1.2
Long Period Acceleration Site Factor (F_v)	1.7

Using the values presented in Tables 1 and 2, point values for developing the design response for the site are presented in Table 3.

Table 3: Point Values for Design Response Spectrum

Point Values	Value
A_s (equal to $F_{pga} \times \text{PGA}$)	0.083
S_{DS} (equal to $F_a \times S_s$)	0.19
S_{D1} (equal to $F_v \times S_1$)	0.078

Due to the low site seismicity, the impact of seismic forces on the stability of bridge approach embankments and the bridge structures is negligible.

SPREAD FOOTING FOUNDATIONS

Spread footing foundations are planned for support of the bridges and wingwalls for both bridge sites as shown in the design plans in Appendix A.

Spread Footing Bearing Resistance & Settlement

The strength and service limit state design analyses for spread footings were completed in accordance with the methods presented in Sections 10.5 and 10.6, respectively, of AASHTO (2012) and with the ADOT Geotechnical Project Development Manual (2025), and ADOT Geotechnical Design Policy SF-1 (2010a). The geotechnical bearing resistance and settlement calculations for the bridges and wingwalls are presented in Appendix D. Based on current design information provided by the design team, the bridges and lowermost wingwalls will be founded on native soils. Upper wingwall steps will be founded on compacted engineered fill placed as backfill for the bridge spread footing and lowest level of wingwalls. The following recommendations require that foundation subgrade preparation is performed in accordance with the requirements presented in this report.

The factored net bearing resistance, q_{Rn} , for strength limit state design was determined using the net nominal bearing resistance (ultimate bearing capacity), q_{nn} , calculated per Section 10.6.3.1.2a and bearing resistance factor, ϕ_b , from Section 10.5.5.2.2 of AASHTO (2012) for walls on level ground. Modified bearing capacity factors were used as per the equation presented in Article 10.6.3.1.2c of AASHTO (2012) for walls in close proximity to a slope. The factor N_q was zero and N_c and N_γ were replaced with N_{cq} and $N_{\gamma q}$, respectively from Figures 10.6.3.1.2c-1 and 10.6.3.1.2c-2 of AASHTO (2012). The parameters presented in Table 4 below were assumed for the nominal bearing resistance and strength limit state analyses.

The spread footing width, length and depth were assigned based on the bridge plans provided in Appendix A. The resulting factored net bearing resistance, q_{Rn} , versus effective footing width, B' , is shown as the "Factored Net Bearing Resistance" line in Figures C-1 to C-5 for Florida Canyon Wash and Figures D-1 to D-3 for Medium Wash.

Table 4 Spread Footing Analysis Parameters – Strength Limit State Design for Bearing for all Spread Footings Bearing on Level Native Soils

Parameter	Symbol	Value
Soil Angle of Internal Friction [degrees]	ϕ_f	28
Soil Total Unit Weight [pcf]	γ_{total}	115
Cohesion [psf]	c	0
Maximum Footing Length [feet] Florida and Medium Wash Box Culverts Wing-Walls	L	102 6 to 25
Footing Bearing Depth of Embedment [feet]	D_f	5
Effective Footing Width [feet] Florida and Medium Box Culverts Wingwalls	B_f	37 5 to 15.5
Bearing Resistance Factor [dim]	ϕ_b	0.45

In accordance with ADOT Geotechnical Design Policy SF-1 (2010a), the modified Schmertmann method presented in Section 8.5 of the Federal Highway Administration Shallow Foundations

Reference Manual (FHWA, 2001) was used to calculate settlements for the service limit state analysis. The parameters assumed for this analysis are presented in Tables 5 and 6 for Florida Canyon Wash and Medium Wash, respectively.

Table 5 Spread Footing Analysis Parameters Service Limit State Design for Bearing for Florida Canyon Wash Bridge and Wingwalls

Parameter	Symbol	Depth Interval [feet] ¹	
		0-5	5-60
Soil Type	--	Sand	Sand
Soil Total Unit Weight [pcf]	γ	120	120
Corrected SPT N-value ³	$(N_1)_{(60)}$	50	40-100
Elastic Modulus [ksi]	E_s	$0.139(N_1)_{(60)}$	$0.139(N_1)_{(60)}$

NOTES:

1. Depth of zero is assumed to be at ground surface.
2. pcf = pounds per cubic foot, ksi = kips per square inch
3. $(N_1)_{(60)}$ = N-value corrected for overburden and normalized to 60% hammer energy efficiency

Table 6 Spread Footing Analysis Parameters Service Limit State Design for Bearing for Medium Wash Bridge and Wingwalls

Parameter	Symbol	Depth Interval [feet] ¹	
		0-15	15-75
Soil Type	--	Sand and Gravel	Sand
Soil Total Unit Weight [pcf]	γ	120	120
Corrected SPT N-value ³	$(N_1)_{(60)}$	20 - 80	70 - 100
Elastic Modulus [ksi]	E_s	$0.167(N_1)_{(60)}$	$0.139(N_1)_{(60)}$

NOTES:

1. Depth of zero is assumed to be at ground surface.
2. pcf = pounds per cubic foot, ksi = kips per square inch
3. $(N_1)_{(60)}$ = N-value corrected for overburden and normalized to 60% hammer energy efficiency

The parameters are based on the measured soil densities, distribution of N values and on the elastic modulus (E_s)-N correlations from AASHTO (2012). Figures C-1 to C-5 for Florida Canyon Wash and D-1 to D-3 for Medium Wash presents the family of service limit state curves developed in accordance with ADOT Geotechnical Design Policy SF-1 (2010a) for design settlements of 0.25, 0.5, 0.75, 1.0, 1.5, and 2.0 inches and effective footing widths, B_f , for spread footings bearing on level native soils.

The modulus of subgrade reaction for the Florida Canyon Wash and Medium Wash box culverts was estimated based on the method in Section 5-4.5 of the Unified Facilities Criteria UFC-3-220-

20 (UFC, 2025). Equation 5-37 in UFC 3-220-20 was used to estimate the modulus of subgrade reaction (k_s) with the following assumptions:

- Width $B = 37$ feet 2 inches (446 inches)
- Depth of embedment $D = 5$ feet (60 inches)
- Subgrade zone of influence below bottom of spread footing $H = 5$ feet (60 inches)
- Based on Figure 5-29 (UFC-3-220-20)
 - $\mu_1 = 0.1$
 - $\mu_0 = 0.98$
- Elastic modulus E_s of the soil within the subgrade zone of influence for the foundation (within 60 inches below bottom of footing) based on correlation with SPT N-values
 - Florida Canyon Wash: $E_s = 14,900$ pounds per square inch (psi)
 - Medium Wash: $E_s = 12,100$ psi

Based on this analysis we recommend the following modulus of subgrade reaction values:

- Florida Canyon Wash: $k_s = 340$ pounds per cubic inch (pci)
- Medium Wash: $k_s = 275$ pci

Sliding Resistance

The factored sliding resistance, R_R , for limit state design should be determined using the nominal sliding resistance between soil and foundation, $R_\square$, and nominal passive resistance, R_{ep} , per Section 10.6.3.4, and corresponding resistance factors, $\phi_\square$ and ϕ_{ep} , from Section 10.5.5.2.2 of AASHTO LRFD (2012). We recommend the parameters presented in Table 7 be used for analyzing sliding resistance.

Passive lateral soil resistance should typically be neglected in the upper 3 feet of finished grade due to the potential for disturbance. Below a depth of 3 feet, the nominal passive resistance can be estimated assuming a hydrostatic pressure distribution of 290 psf per foot for bridge and wingwall footings bearing on level native soils.

Table 7 Spread Footing Analysis Parameters - Strength Limit State Design for Sliding of Bridges and Wingwalls Bearing on Level Native Soils

Parameter	Symbol	Value
Factored Sliding Resistance		
Resistance Factor for Shear between Soil and Foundation	ϕ_{τ}	0.90 ¹
Resistance Factor for Passive Resistance	ϕ_{ep}	0.50
Nominal Sliding Resistance		
Soil Angle of Internal Friction	ϕ_f	28 degrees
Soil Total Unit Weight	γ	115 pcf
Cohesion	c	0
Passive Earth Pressure Coefficient	K_p	2.76

NOTES:

1. Use resistance factor of 0.90 for soil-on-soil interface for the bottom horizontal plane of footing between toe and front of key. For remainder of footing bottom use values provided in Table 10.5.5.2.2-1 (AASHTO, 2012).

Lateral Earth Pressures

Abutment walls and wingwalls which retain soil should be designed for the lateral earth pressure imposed by the soil. The magnitude of the lateral earth pressure is a function of the backfill material, imposed surcharge loads, drainage accommodations and the rigidity of the retaining structure. The recommended lateral earth pressure values presented below assume the backfill will be structure backfill comprised of granular soils which meet the requirements of Section 203 of the current ADOT Standard Specifications (ADOT, 2021). The limits of structure backfill placement are assumed to be the entire limits of excavations for the abutments and abutment wingwalls, and in all cases the structure backfill should extend a minimum of 3 feet laterally from the back face of all walls.

Walls free to deflect a minimum of 0.2 percent of the wall height should be designed for the full active earth pressure condition and an active equivalent fluid unit weight of 35 psf per foot of wall height. Walls restrained from lateral movement should be designed for the at rest condition using an equivalent fluid unit weight of 55 psf per foot of wall height. Retaining walls should be designed to drain water and avoid hydrostatic pressures. These recommendations assume a horizontal backfill surface, no surcharge loadings and adequate drainage. Surcharge loads from traffic, sloped wall backfill, or other sources, will impose additional pressures. Vertical surcharge loads (e.g. traffic loading) should be added to the above earth pressures after multiplying the surcharge loads by an earth pressure coefficient of 0.30 for active conditions, and 0.46 for at-rest conditions. These values are based on an internal friction angle of 33 degrees for the structure backfill.

Horizontal loads acting on foundations cast-in-place in open excavations against undisturbed native soil or properly placed and compacted engineered fill will be resisted by friction acting along the base of the footing and by passive earth pressure against the loaded side of the footing. If the design makes use of passive earth pressure against backfill, it is important that a representative of the geotechnical engineer be present to monitor and test backfill placement and compaction in order to develop passive resistance with low strains.

If heavy mechanical compaction equipment will be operating within a distance of one-half the retained height (defined as being from the backfill finished grade at the back of the wall to the wall base), additional earth pressure induced by compaction should be used in wall design. The additional earth pressure should be estimated using the procedure presented by Clough and Duncan (1991). If compaction equipment used adjacent to the walls is to consist of small rollers and tampers, the additional earth pressure should not be considered.

The seismic lateral earth pressure component applied to box culvert abutments and wing-walls was estimated using the basic procedure of Mononobe-Okabe (M-O) in accordance with Article 11.6.5 and Appendix A11.3 of AASHTO (2012), with modifications according to Agusti and Sitar (2013). The seismic horizontal acceleration coefficient utilized was the peak ground acceleration modified by the short-period site factor (F_{PGA}) from Table 1, equal to 0.069 g. Seismic lateral earth pressures were estimated for both rigid, restrained non-yielding walls which are not free to yield to a degree sufficient to develop active earth pressure (such as abutment walls), and conventional cantilever retaining walls which are sufficiently flexible such that active earth pressure will develop (such as wing walls). Structure backfill was assumed level, cohesionless and unsaturated with a unit weight of 125 pcf and friction angle of 36 degrees.

Estimated seismic lateral earth pressure components (equivalent fluid pressures) are as follows:

- Rigid, restrained non-yielding walls – 5.9 pcf
- Conventional cantilever retaining walls – 3.6 pcf

The point of application of the resultant seismic load component is at $1/3H$ from the wall base, where H is the retained height.

CONSTRUCTION CONSIDERATIONS

Subgrade Preparation

The spread footing foundations for the bridges and wingwalls will be constructed on either native soils or compacted engineered fill soils. Subgrade soil should be prepared in accordance with Section 203 of the ADOT Standard Specifications (ADOT, 2021) and the following requirements.

The subgrade preparation beneath the foundation elements shall ensure that trash, debris, vegetation (including roots) and other organics, any existing spread fill, any unstable soils (such as soft, loose, disturbed, water softened, sediments, collapsible, or expansive soils) , and other deleterious materials is removed prior to construction. The extent of removal of unsuitable materials should be as directed by the Geotechnical Engineer. Subgrade preparation should extend laterally a minimum of 2 feet beyond the edge of the footing.

For spread footing foundations that will be constructed on native soils or compacted engineered fill soils the following subgrade preparation is required:

- Over-excavate a minimum depth of 8 inches below bottom of footing elevation.
- Scarify subgrade to a minimum depth of 8 inches below depth of over-excavation.
- Moisture-condition the scarified subgrade to within the limits of +/-2 percent of the optimum moisture content as determined by ASTM D698.
- Compact to a minimum dry density of 100% of the Standard Proctor effort in accordance with ASTM D698.
- Loose or soft zones within the subgrade which are observed during excavation and scarification should be over-excavated to contact with dense and undisturbed material and replaced with properly moisture-conditioned and compacted material.
- After compaction of the subgrade soil 8 inches of aggregate base shall be placed and compacted:
 - The aggregate base shall be moisture-conditioned to within the limits of +/-2 percent of the optimum moisture content as determined by ASTM D698.
 - The aggregate base shall be compacted to a minimum dry density of 100% of the Standard Proctor effort in accordance with ASTM D698.

All subgrade soils should be observed and approved by a representative of the Geotechnical Engineer before placement of foundations.

Fill Material Requirements

The existing material excavated for the spread footings can be reused as engineered fill material for new embankment fill subject to meeting the following requirements:

- free from organics or other deleterious materials
- maximum particle size of 6 inches

- maximum of 40 percent passing the #200 U.S. standard sieve
- maximum Plasticity Index of 15

Fill Placement Requirements

New engineered fill material shall be placed on properly prepared subgrade that meets the previously described requirements. Proper compaction of engineered fill material is very important to reduce the potential for settlement of the spread footings. Engineered fill material placement and compaction shall meet the following requirements:

- Loose lifts of engineered fill shall be a maximum thickness of 8 inches.
- Key-in new engineered fill material into the adjacent existing fill or native soil in sloped areas in accordance with Section 203-10.03 of the ADOT Standard Specifications.
- Moisture-condition the engineered fill to within the limits of +/-2 percent of the optimum moisture content as determined by ASTM D698.
- Compact to a minimum dry density of 100% of the Standard Proctor maximum dry density in accordance with ASTM D698.
- Prospective fill material sources shall be inspected and tested to verify compliance with the above-described engineered fill material requirements; any material which does not meet those requirements shall be rejected.

Removal of Existing Bridge Foundations

The existing bridges at Florida Canyon Wash and Medium Wash will be removed prior to the construction of the new bridge crossings. It is understood that the existing bridge abutments and piers may be founded on driven piles. If so, the piles shall be removed to a minimum depth of 4 feet below the bottom of the bridge bottom slab. After the piles are removed the excavations shall be backfilled according to the following requirements:

- Moisture-condition the excavated soils to within the limits of +/-2 percent of the optimum moisture content as determined by ASTM D698.
- Place in maximum loose lifts of 8 inch thickness.
- Compact to a minimum dry density of 95% of the Standard Proctor maximum dry density in accordance with ASTM D698.

Alternatively, the excavations may be backfilled with controlled low strength material (CLSM). CLSM shall be in accordance with Section 501-2.04 of the Pima Association of Governments

Standard Specifications for Public Improvements (PAG, 2015) expect that the CLSM shall have a minimum Portland cement content of $\frac{1}{2}$ sack per cubic yard of CLSM and a compressive strength of not more than 50 psi.

Temporary Excavations

Temporary excavation slopes should be made in accordance with OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, Subpart P. It is the responsibility of the Contractor to design safe excavations for the construction. All excavations should be protected against water infiltration from surface runoff or other sources. Moderate to severe raveling and erosion of excavation slopes may occur due to water infiltration or surface runoff. Heavy equipment, traffic, and excavation spoils should be permitted no closer than 10 feet from the edge (crest) of any excavation.

REFERENCES

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APPENDIX A

Selected Design Plans



PIMA COUNTY BOARD OF SUPERVISORS
REX SCOTT, CHAIR, DISTRICT 1

MATT HEINZ, DISTRICT 2 JENNIFER ALLEN, DISTRICT 3
STEVE CHRISTY, DISTRICT 4 ANDRÉS CANO, DISTRICT 5
THIS PROJECT IS LOCATED WITHIN SUPERVISOR DISTRICT 4

MADERA CANYON ROAD

Florida Canyon Wash Bridge Replacement

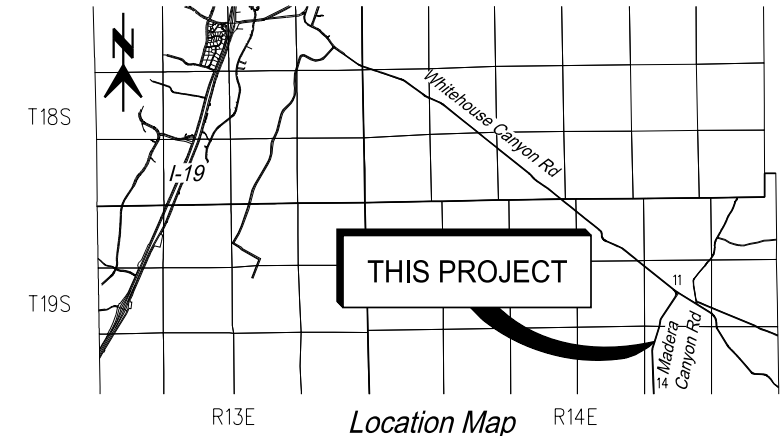
FEDERAL PROJECT NO. PPM - 0(273)D



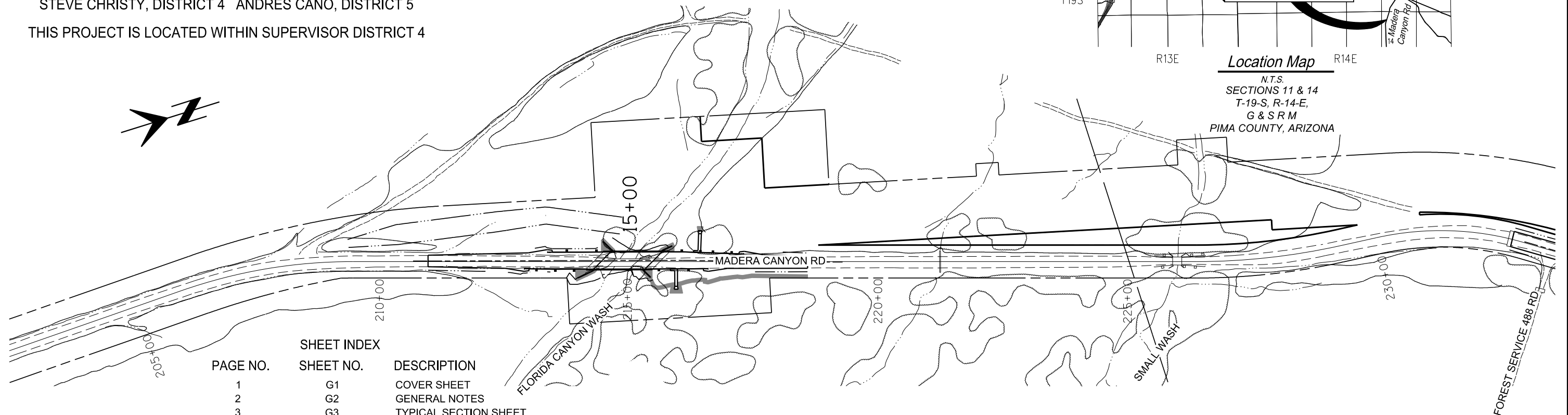
GENERAL DESCRIPTION OF PROJECT

The proposed scope of work for this project includes the removal of existing concrete slab bridge, construction of a new bridge with bank protection, asphalt concrete surface roadway, temporary detour, and other incidental items.

ADOT PROJECT NUMBER T0540
PIMA COUNTY PROJECT NUMBER 4MADFL



Location Map
N.T.S.
SECTIONS 11 & 14
T-19-S, R-14-E,
G & S R M
PIMA COUNTY, ARIZONA



PAGE NO.	SHEET NO.	DESCRIPTION
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7	R1	ROADWAY PLAN & PROFILE SHEET
8 - 12	RD1 - RD5	ROADWAY DETAILS (R-Series)
13 - 17	SM1 - SM5	PAVEMENT MARKING & SIGNING SHEETS
18 - 27	TC1 - TC10	TRAFFIC CONTROL & DETOUR PLAN & PROFILE SHEETS
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68 - 70	NPI01 - NPI03	DETOUR NATIVE PLANT INVENTORY SHEETS

INITIAL PS&E SUBMITTAL

NOVEMBER 2025



No.	Revisions	Engineer	Date
No.	As Built	Engineer	Date

INITIAL
PS & E
SUBMITTAL
NOT FOR
CONSTRUCTION
OR RECORDING

Pima County
Department of Transportation
201 N. Stone Ave. 4th Floor
Tucson, Arizona 85701
Phone Number: 520-724-6410
Kathryn Skinner, P.E., Director

Approved: _____ 20____
Kathryn Skinner, P.E.



Project ID: 10416569
Client Number: 4106
PenTable: COTFMA_PL 010809.TBL
PlotDriver: 10416569_18hair_BkW_PDF.plt

GENERAL NOTES

1. Construction shall be in conformance with the specifications and details listed in the special provisions.
2. Utility locations shown on plans were compiled based on the best information available to the Department, utility locations are not intended to be exact or complete. Prior to commencing construction, the Contractor shall verify the location of all utilities with the appropriate organizations. Contact "Blue Stake" at 1-800-782-5348, two full working days prior to beginning construction (Saturdays and Sundays are not considered working days).
3. Right-of-Way encroachments shall be removed only by order of Pima County, unless noted.
4. Removal of all cacti and native plants shall be in accordance with the provisions of the "Arizona Native Plant Law" A.R.S. Chapter 7 and Pima County Native Plant Preservation Ordinance Title 18 Chapter 18.72.
5. The Basis of Bearing for this project, N89°30'06"E, was derived using the Arizona Coordinate System, North American Datum (NAD) 1983 (1992), Central Zone 0202, in International feet, and observed between Pima County Control Pt. *3663 (BM #2, a found 3-1/8" brass disk in concrete headwall at the northeast corner of the bridge over Medium Wash) to Pima County Control Pt. *3674 (BM #3, a found 3-1/8" brass disk in concrete headwall at the northeast corner of the bridge over Florida Canyon Wash). Said basis of bearing = South 19°53'16.3" West. Said bearing established on P.C.H.D. Projects 4MCAMW and 4MCAFW and recorded Survey Book 26 Page 10 (Seq. 20021010193) at the Pima County Recorder's Office.
6. The Basis of Elevation originated from Pima County bench mark P399 (A found 3-1/2" brass disk in 1" concrete cylinder). Said bench mark is located at the southwest corner of Madera Canyon Road and Whitehouse Canyon Road with an elevation of 3677.62 feet (NAVD-88) (P.C.H.D. Projects 4MCAMW and 4MCAFW and recorded Survey Book 26 Page 10 (Seq. 20021010193) at the Pima County Recorder's Office.
7. The project surface coordinates are derived from state plane grid values by using the following formulas. A combined scale factor 0.999846886 was used to convert grid coordinates to project surface coordinates. Surface Northing and Easting coordinates are derived by dividing the grid coordinates by 0.999846886 and subtract 200,000 feet from project northings and subtract 1,000,000 feet from project eastings.
- | | | Northing | Easting |
|-------------|--------------|----------------|---------|
| *3663" Grid | 288,136.2340 | 1,020,749.1990 | |
| Surface | 88,180.3644 | 20,905.5139 | |
| *3674" Grid | 285,998.5790 | 1,019,975.8890 | |
| Surface | 86,042.3761 | 20,132.0855 | |
8. The Contractor shall maintain access to all driveways, alleys, and mailboxes during construction. The Contractor will not restrict Emergency Vehicles, U.S. Postal Delivery, Solid Waste Collections, and/or access to the adjacent properties, except as approved by the Engineer.
9. Soils information will be made available to prospective bidders in the geotechnical report. Soils information so provided shall be for information purposes only. This information was developed as accurately as possible by the methods used. Pima County accepts no responsibility for any conditions encountered which vary from the information provided.
10. Existing topographic conditions shown on plan sheets reflect conditions as of August 10, 2000 and were generated by P.C.H.D. Projects 4MCAMW and 4MCAFW. Certain missing and match-in areas have been updated with recent verification and supplemental surveys.
11. Omissions or conflicts between various elements of the drawings, notes, and details shall be brought to the attention of the Engineer and resolved before proceeding with the work.
12. All stationing shown on the plans is based upon the centerline as noted. See Geometric Layout Sheets.
13. Existing utilities include, but may not be limited to, overhead and underground electric, communication, and irrigation, and shall be moved by others unless otherwise noted and shown in these plans.
14. The current regulatory posted speed limit is 45 MPH with 25 MPH advisory speeds throughout the length of the project. The design speed is: 45 MPH.
15. The horizontal control and right-of-way lines for this project are based upon information provided on this project Right of Way Plan Sheets.
16. The Basis of Stationing for the Existing R/W Centerline was determined from found centerline point of intersection monuments and their reference markers along with PCDOT alignment study and field notes performed by Walter Burg County Engineer in 1961 project number R-AD-16(4).

17. The Basis of Stationing for the Existing Survey Centerline was determined from found R/W markers established by and according to PCDOT project numbers 4MCAMW & 4MCAFW and ADOT project numbers 0000 PM PPM SB405 OIC & 0000 PM PPM SB406 OIC which was filed as a Record of Survey at the Pima County Recorder's office at Book 26 Pg 10 also known as Sequence 20021010193.

TRAFFIC DATA

Madera Canyon Road	2025 ADT 537	2040 ADT 740
--------------------	-----------------	-----------------

LENGTH OF PROJECT

STA. 11+00.00 to STA 18+60.00 = 760' = 0.144 miles

EARTHWORK NOTES

1. For estimating purposes, earthwork quantities assume that all on-site materials are not acceptable for use as pipe bedding, pipe backfill, and structure backfill.
2. For estimating purposes, earthwork quantities assume existing pavement and borrow excavation are acceptable for use as roadway embankment. All other structural excavation is assumed not acceptable for use as roadway embankment without additional processing.
3. Roadway Embankment volume includes riprap along bridge headwalls and roadway embankment fill slopes. For Net Embankment Demand, Riprap volume is subtracted out.

EARTHWORK QUANTITIES

Item No.	Item Description	Total
EXCAVATION		
2020029	Existing Pavement Removal	135 C.Y.
2030300	Roadway Excavation	5,033 C.Y.
2030301	Detour Excavation	6,372 C.Y.
	Structural Excavation	4,265 C.Y.
	Available Excavation (See Note 2)	11,405 C.Y.
	Shrink (10%)	1,141 C.Y.
	Net Available Excavation	10,264 C.Y.
EMBANKMENT		
	Roadway Embankment (See Note 2 & 3)	3,037 C.Y.
	Detour Embankment	3,588 C.Y.
	Ground Compaction (0.1')	94 C.Y.
9130015	Riprap (D ₅₀ =6") (See Note 3)	130 C.Y.
9130016	Riprap (D ₅₀ =12") (See Note 3)	50 C.Y.
	Net Embankment Demand (See Note 3)	6,539 C.Y.
2030901	Borrow	0 C.Y.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0127310	2		
		T0540 OIC			

Contact Arizona 811 at least two full working days before you begin excavation



Call 811 or click Arizona811.com

Date	11/20/25	11/20/25	11/20/25
Designed	JAR	JAR	JLB
Drawn	JAR	B/K	
Checked			
Proj. Engr.			

No.	Revision	Description	Engineer	Date

INITIAL
PS&E
SUBMITTAL
Not For
Construction
or Recording

HCR

MADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADF-L

Kathryn Skinner, P.E., Director

Pima County Department of Transportation

Madera Canyon Road, Florida Canyon Wash Bridge Replacement (4MADEL)

GENERAL NOTES

Scales	Horiz.: N/A Vert.: N/A	Sheet G2 of G6	Page 2 of 70
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Aluminum Cap on Pipe	A.C.P.
Abandoned	Aband.
Arizona Department of Transportation	ADOT
Control	Ctrl.
Correction	Corr.
Decomposed Granite	D.G.
Detail	Dtl.
Drainage Easement	D.E.
Edge Of Pavement	E.P.
General Land Office	G.L.O.
Intelligent Traffic System	ITS
Median	Med.
Pima Association of Governments	PAG
Point Of Beginning	P.O.B.
Point Of End	P.O.E.
Point of Information	P.O.I.
Raised Pavement Marker	R.P.M.
Shoulder	Shld.
Standard	Std.
Stopping Sight Distance	SSD
Temporary Construction Easement	T.C.E.
Vertical Curve	V.C.

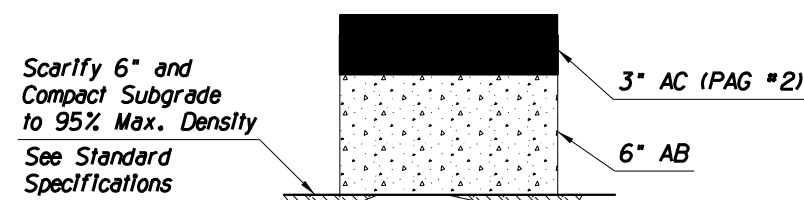
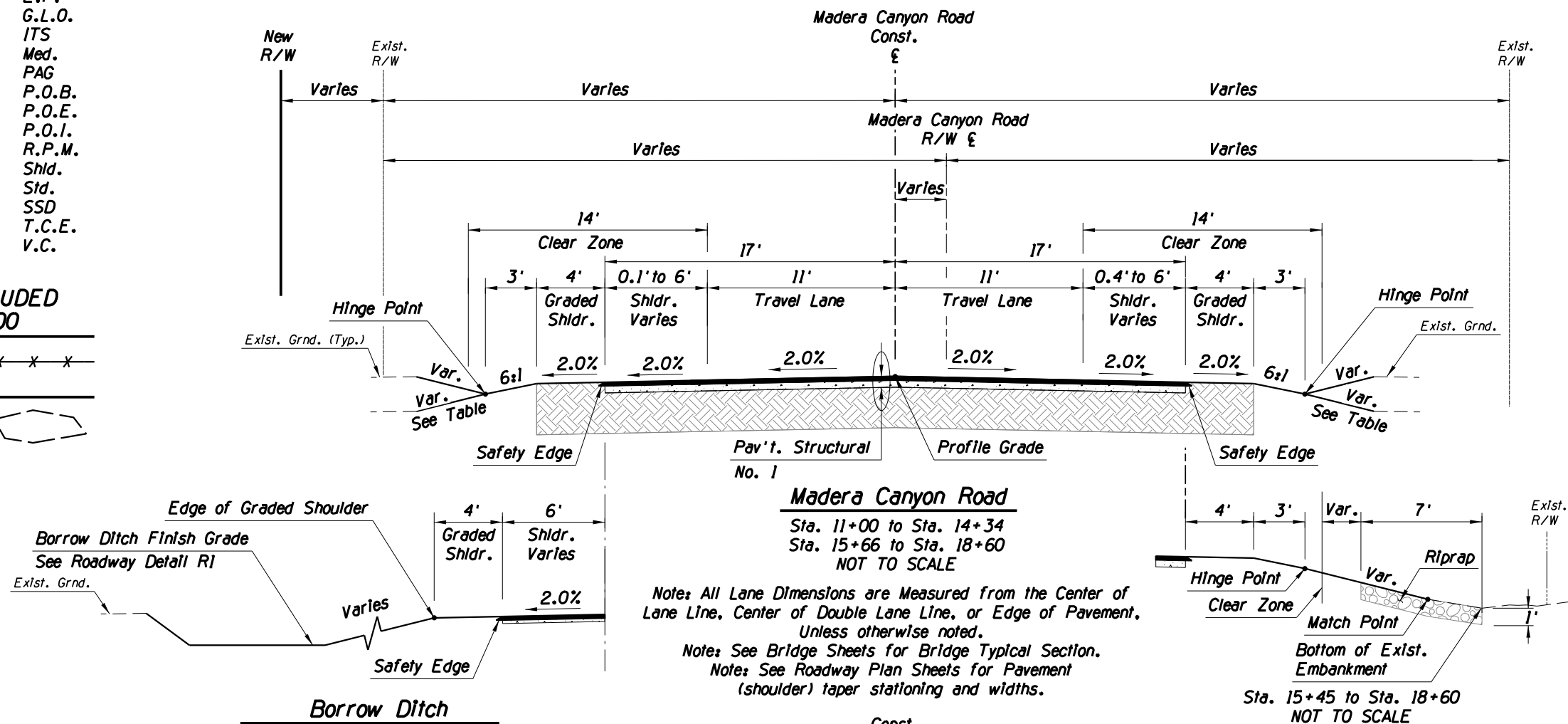
New Barb Wire Game Fence

New R/W

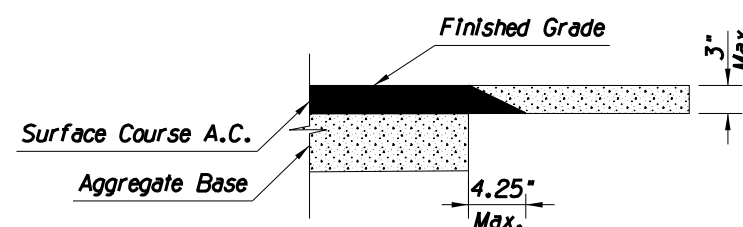
Potential Borrow & Staging Area

FLORIDA CANYON WASH SLOPE TABLE					
LEFT			RIGHT		
Start Sta.	End Sta.	Slope	Start Sta.	End Sta.	Slope
11+00	13+10	21.2%-6.9% Fill (Ditch)	11+00	13+90	4:1 Cut/Fill
13+15	13+30	6:1 Cut	14+00	14+30 (Bridge)	2:1 Fill
13+35	13+45	3:1 Cut	15+33 (Bridge)	15+50	2:1 Fill
13+50	14+35	4:1 Cut	15+60	End	4:1 Cut/Fill
14+50	14+67 (Bridge)	2:1 Fill			
15+70 (Bridge)	15+90	2:1 Fill			
16+00	End	4:1 Cut/Fill			

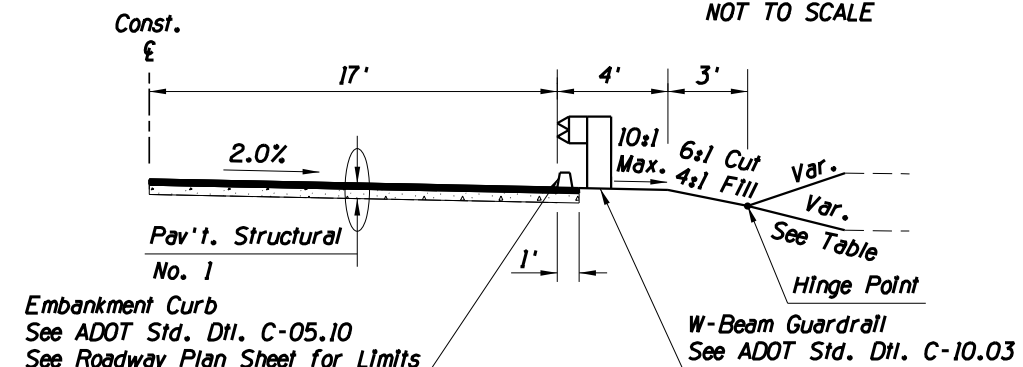
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0(273)D			
		T0540 OIC			



Pavement Structure No. 1
Madera Canyon Rd Sta. 11+00 to Sta. 18+60
NOT TO SCALE



Safety Edge Detail
NOT TO SCALE



Typical Half-Section @ Guardrail
Symmetric About Const. ϵ
NOT TO SCALE

TYPICAL SECTION

	Date
Designed	JAR
Drawn	JAR
Checked	BJK
Proj. Engr.	LJB

No.	Revision Description	Engineer	Date

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Construction
or Recording*

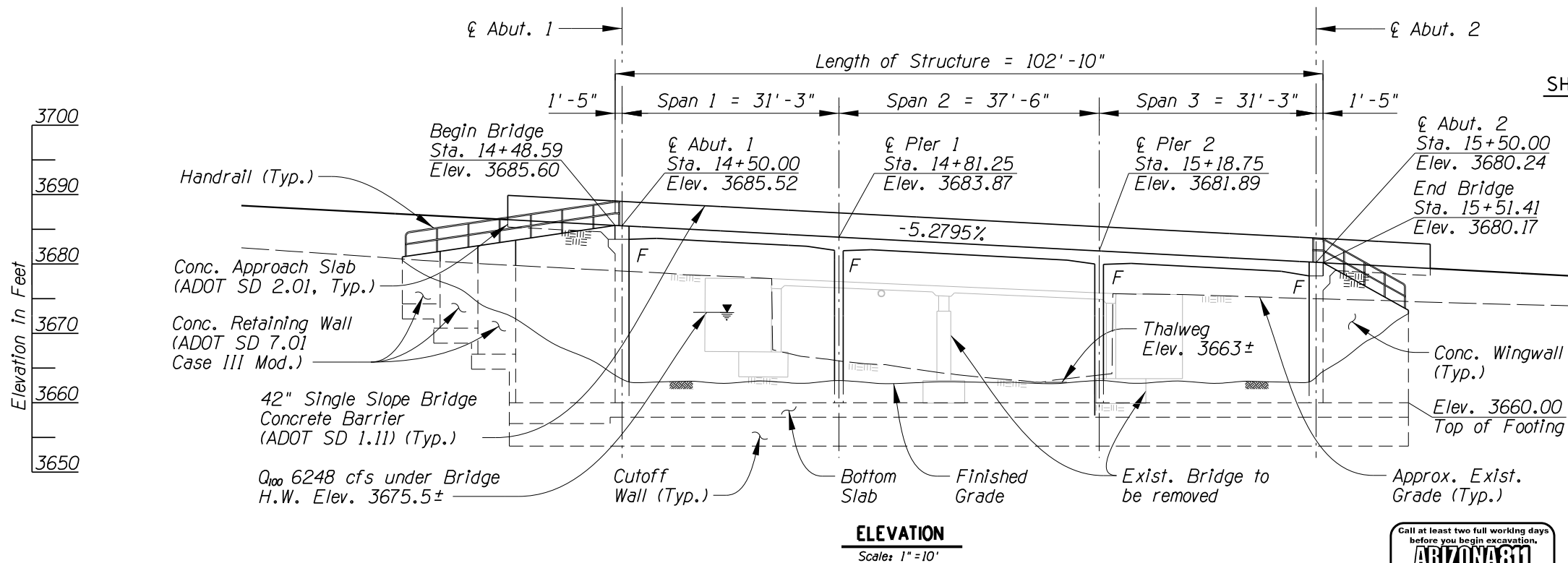
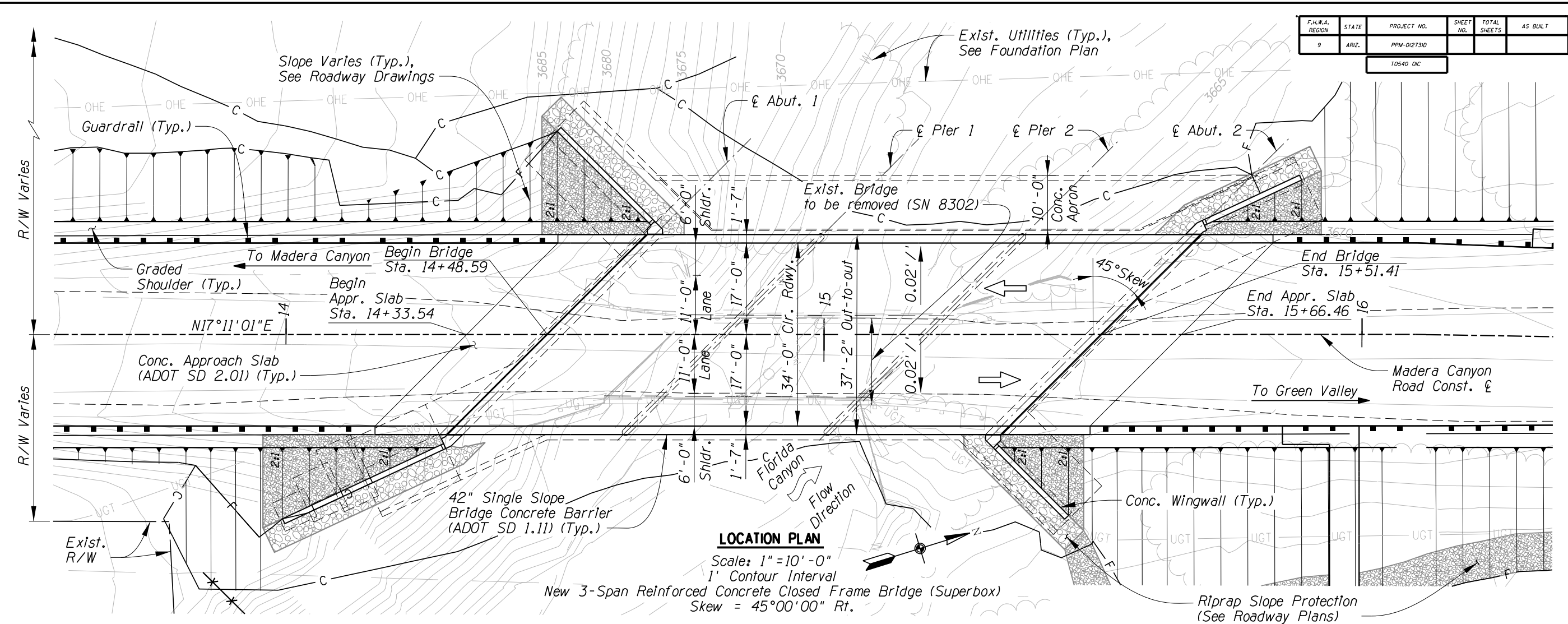


MADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADFL

Kathryn Skinner, P.E., Director

Pima County Department of Transportation

Madera Canyon Road, Florida Canyon Wash Bridge Replacement (4MADFL)



SHEET INDEX

SHEET NO.	TITLE
B1	Plan & Elevation
B2	Typical Section & Quantities
B3	General Notes
B4	Excavation & Backfill
B5	Foundation Plan & Notes
B6	Abutment Footing Details
B7	Abutment 1 Plan & Elevation
B8	Abutment 2 Plan & Elevation
B9	Abutment & Wingwall Details 1
B10	Abutment & Wingwall Details 2
B11	Abutment & Wingwall Details 3
B12	Bottom Slab Details
B13	Pier Details
B14	Deck Slab Details
B15	Camber & Screed Elevations



PLAN & ELEVATION

Kathryn Skinner, P.E., Director

Date	06/2025
Designed	GWS
Drawn	TRK
Checked	DL
Proj. Engr.	TWB

No.	Revision	Description	Engineer	Date

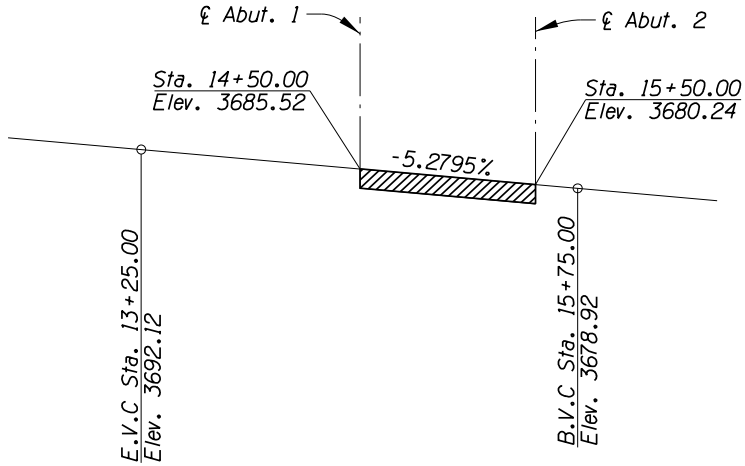
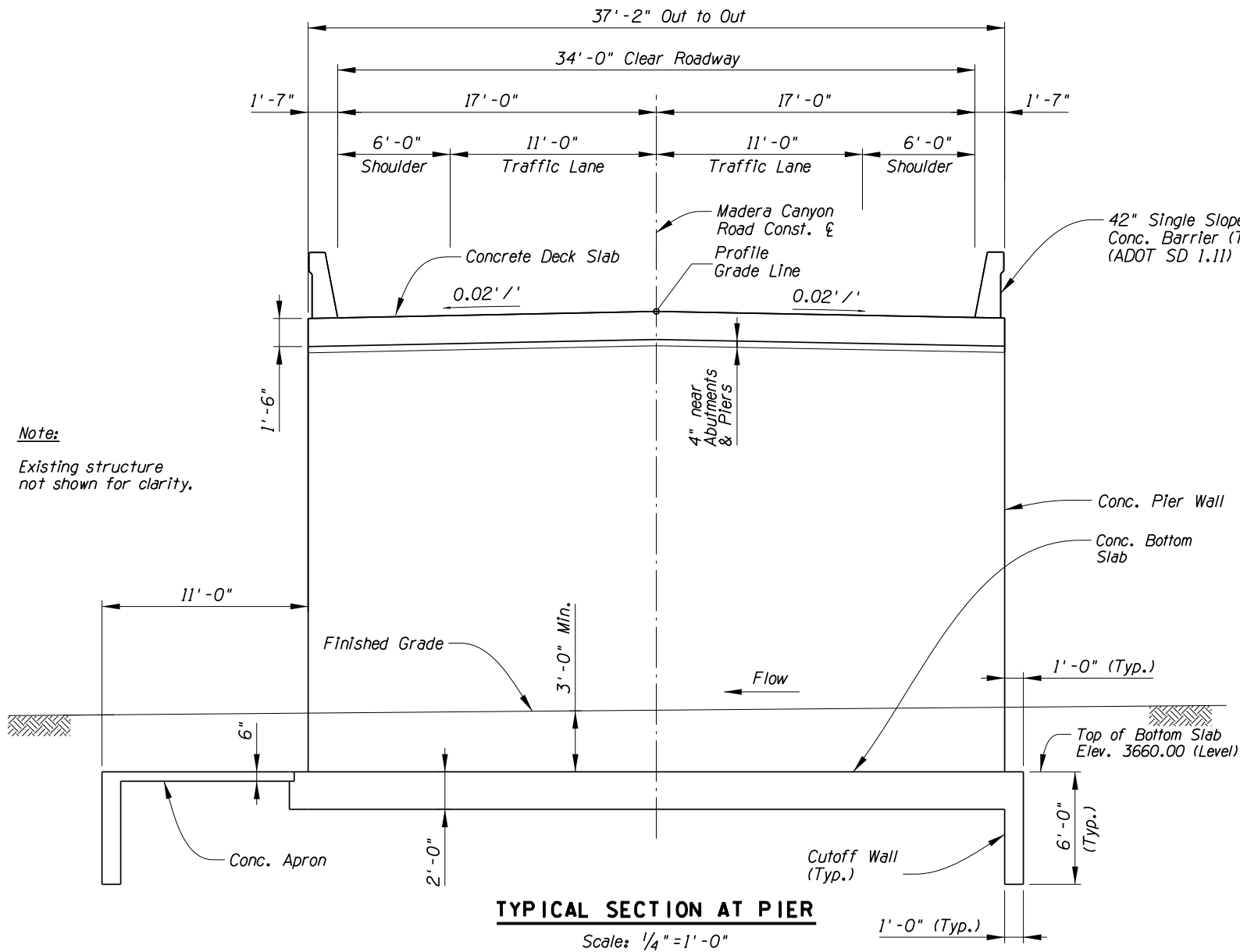
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MADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MA0FL

Pima County Department of Transportation

Madera Canyon Road, Florida Canyon Wash Bridge Replacement (4MA0FL)



Approximate Quantities					
Item	Structural Excavation	Structure Backfill	Class 'S' Concrete	Class 'X' Concrete	Reinforcing Steel
			f'c=3,500 psi	f'c=4,500 psi	
	C.Y.	C.Y.	C.Y.	C.Y.	LB.
Abutment 1	-	185	170	-	41,680
Pier 1	-	-	54	-	17,860
Pier 2	-	-	49	-	16,790
Abutment 2	-	145	116	-	34,900
Bottom Slab, Wingwall Ftgs., & Upstream Cutoff Wall	3,705	-	451	-	63,180
Concrete Apron & Downstream Cutoff Wall	510	-	47	-	5,055
Superstructure	-	-	-	225	66,110
Total	4,215	330	887	225	245,570
As Built Total					

Remove Bridge.....1 L.S.
Aggregate Base.....160 C.Y.
42" Single Slope Bridge Concrete Barrier and Transition (ADOT SD 1.11).....266 L.F.
Approach Slab (ADOT SD 2.01).....1,119 S.F.
Retaining Wall (ADOT SD 7.01).....222 S.F.
Handrail (PAG Std. Dtl. 105).....85 L.F.

Notes:

- Wingwall quantities are included in abutment quantities. Wingwall footing quantities are included in bottom slab quantities. Retaining walls (ADOT SD7.01) are quantified by square foot.
- Single slope bridge barrier quantities include concrete barrier transition on top of approach slab.
- Quantities for structural excavation and structure backfill are provided for information only. These are not direct pay items in this contract and shall be considered incidental to the bridge construction.
- All excavated material shall be placed back over the new bottom slab and channel shall be graded to the approximate finished grade shown on the plans and to the original flow line as directed by the Engineer. Cost shall be incidental to other contract items.



TYPICAL SECTION & QUANTITIES

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0121310			
T0540 DIC					

Kathryn Skinner, P.E., Director

No.	Revision	Description	Engineer	Date

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MADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADF-L

Madera Canyon Road, Florida Canyon Wash Bridge Replacement (4MADEL)

GENERAL NOTES:

Design Specifications

AASHTO LRFD Bridge Design Specifications, 9th Edition 2020 except as superseded by ADOT Bridge Design Guidelines.

Construction Specifications

Pima Association of Governments (PAG) Standard Specifications for Public Improvements 2015 Edition and the Special Provisions.

Design Loadings

Dead Load - Dead Load Includes allowance of 25 pounds per square foot (psf) for future wearing surface.

Live Load - AASHTO HL-93.

Hydraulic Design Criteria

Drainage Information provided by HDR Engineering, Inc. for Pima County Department of Transportation Project No. 4MADFL (HDR Project No. 10416569), November 2025.

Q₁₀₀ is based on the 100-yr precipitation levels increased by 15% in accordance with Pima County Flood Control Technical Policy, TECH-010.

Q₁₀₀ = 6248 cfs, V₁₀₀ = 15.0 fps, H.W. Elevation = 3675.5
Q₅₀₀ = 6285 cfs, V₅₀₀ = 15.0 fps, H.W. Elevation = 3675.6

Concrete and Reinforcement Strengths

Superstructure except Barriers (Class X) f'c = 4500 psi
Abutments, Pier Walls, Bottom Slab, Wingwalls, f'c = 3500 psi
Concrete Apron, and Cutoff Walls (Class S)
Approach Slabs and Barriers (Class S) f'c = 4000 psi
Grade 60 Reinforcing Steel fy = 60,000 psi
Grade 60 Longitudinal Deck Reinforcing Steel fs = 28,000 psi

Reinforcing steel shall conform to ASTM A615. All reinforcing shall be furnished as Grade 60.

All Mechanical splices of reinforcing steel shall develop 125% of the yield strength of the reinforcing bar and shall conform to the requirements for mechanical connections in Section 605-3.02 of the Standard Specifications.

All bends/hooks shall meet the requirements of AASHTO LRFD, Article 5.10.2.
All bend dimensions for reinforcing steel shall be out-to-out of bars.
All placement dimensions for reinforcing steel shall be to center of bars, unless noted otherwise.

All reinforcing shall have 2 inch clear cover, unless noted otherwise.

Concrete Barriers & Parapets

Concrete barriers shall be constructed after concrete deck falsework has been removed.

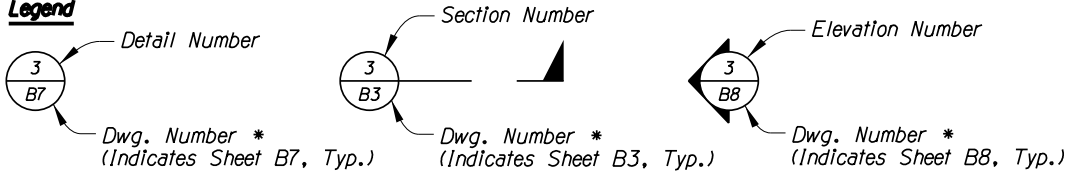
Concrete barriers shall not be slip formed.

Dimensions

Dimensions shall not be scaled from drawings. All dimensions are in feet and inches and all stations and elevations are in feet.

Vertical dimensions are measured plumb, unless noted otherwise.

Legend



* "-" Indicates Section or Detail is located on same drawing.

Construction Joints

All roughened construction joints to be roughened to 1/4" minimum amplitude.

Coordination

Contractor shall coordinate all existing conditions during construction of project. Utility information shown on the plans may not be complete or accurately depict the location of the facilities shown. The contractor shall coordinate the location of all existing, new, relocated, and abandoned utilities with the project plans and notify respective owners before commencing the work of excavation. Conflicts shall be brought to the attention of the Engineer and resolved prior to proceeding with the work.

Chamfer

All exposed corners shall be chamfered 3/4" unless noted otherwise. See Chamfer Detail this Sheet.

Standard Drawing List

ADOT Bridge Group SD Drawings - SD 1.11, SD 2.01, and SD 7.01.
PAG Standard Detail Drawings - Std. Dtl. 105.

Inventory and Operating Rating

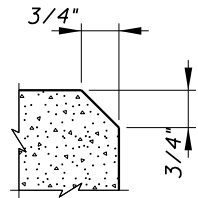
Inventory and operating ratings for HL-93 are in accordance with AASHTO Manual for Bridge Evaluation, 3rd Edition 2018 with Interim Revisions through 2019 and with the Load and Resistance Factor Rating Method.
Inventory Load Rating Factor: 1.xx
Operating Load Rating Factor: 2.xx

Existing Bridge Removal

The existing Madera Canyon Road Bridge at Florida Canyon Wash (Structure No. 8302) is a two-span cast-in-place slab bridge constructed in 1935. The Contractor shall remove the existing bridge. See Special Provisions.

Seismic

The bridge site is Site Class D with peak ground acceleration (PGA) = 0.069g and horizontal response spectral acceleration coefficient at 0.2 sec return period (S_s) of 0.158g, and horizontal response spectral acceleration coefficient at 1.0 sec return period (S₁) of 0.046g. The bridge site is classified as Seismic Zone 1.



Chamfer all exposed corners thus unless otherwise noted.
This note applicable to all sheets pertaining to the structure.

CHAMFER DETAIL
No Scale

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0127310			
T0540 DEC					

Kathryn Skinner, P.E., Director

Date	GWS	TRK	DL	TWB
06/2025				
06/2025				
06/2025				
06/2025				

No.	Revision Description	Engineer	Date

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Construction
or Recording

HDR

MADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADFL

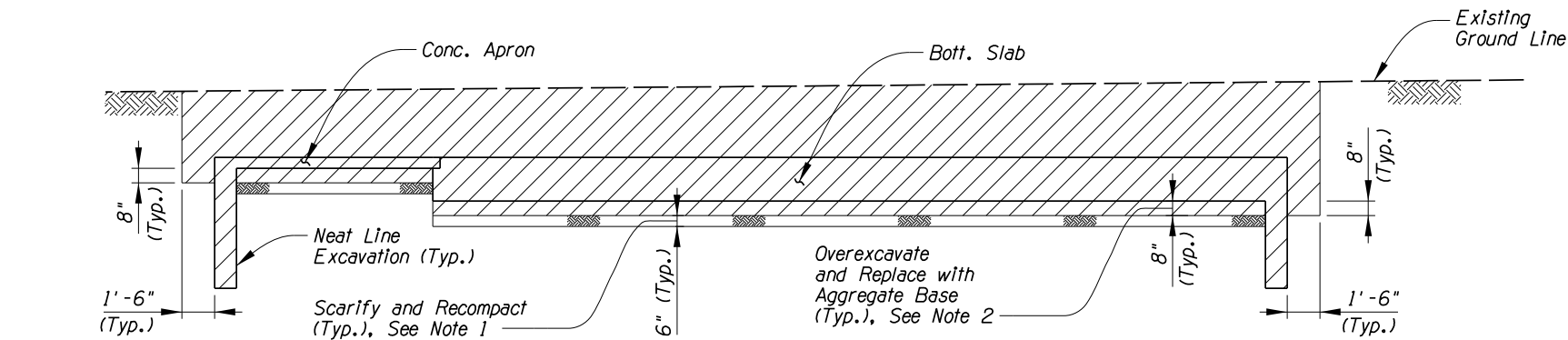
Pima County Department of Transportation

Madera Canyon Road, Florida Canyon Wash Bridge Replacement (4MADFL)



GENERAL NOTES

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Client Number: 4108
Pentable: COTPMALPLOT000R.TBL
Plotdriver: 10416569_Ventil-B&W_PDF.plt

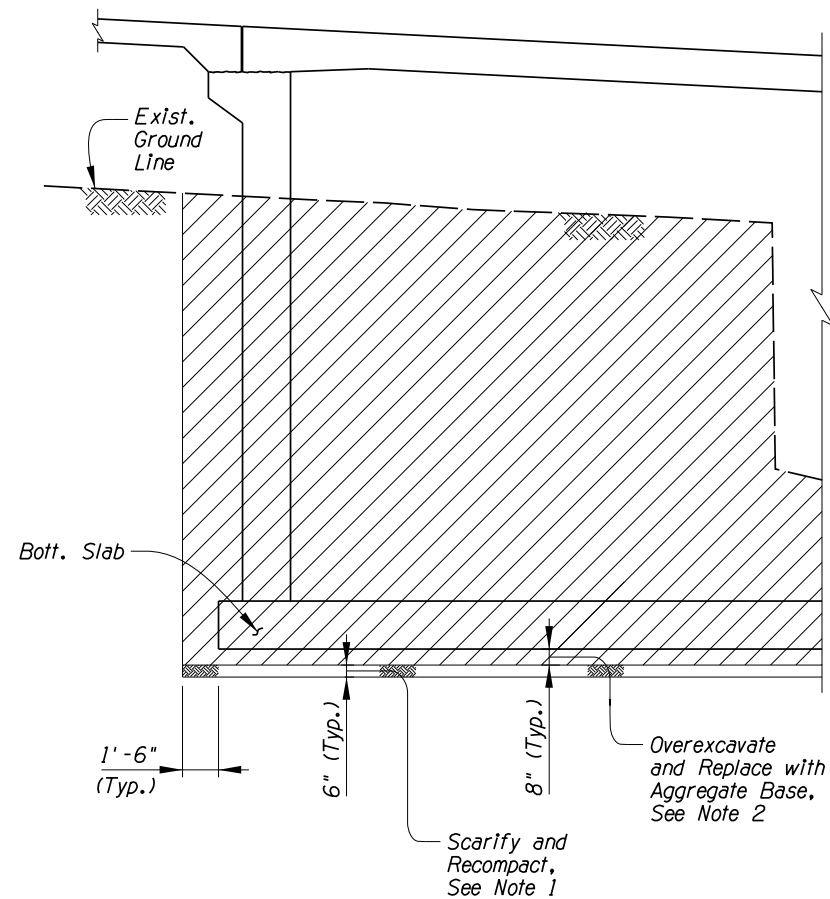


TYPICAL TRANSVERSE SECTION

STRUCTURAL EXCAVATION LIMITS

Scale: 1/4" = 1'-0"

1

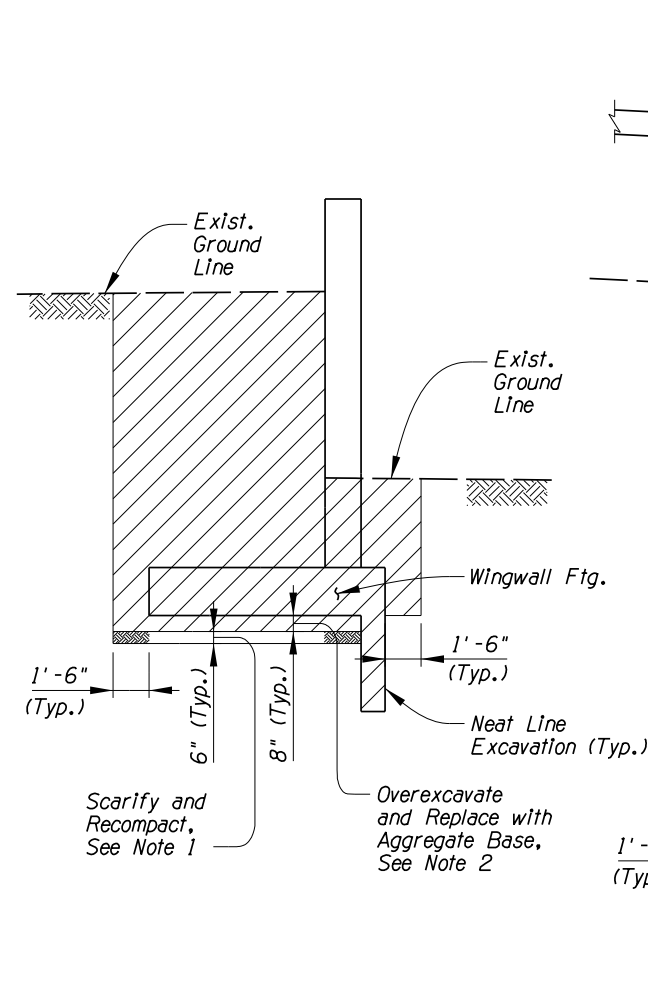


STRUCTURAL EXCAVATION - ABUTMENT

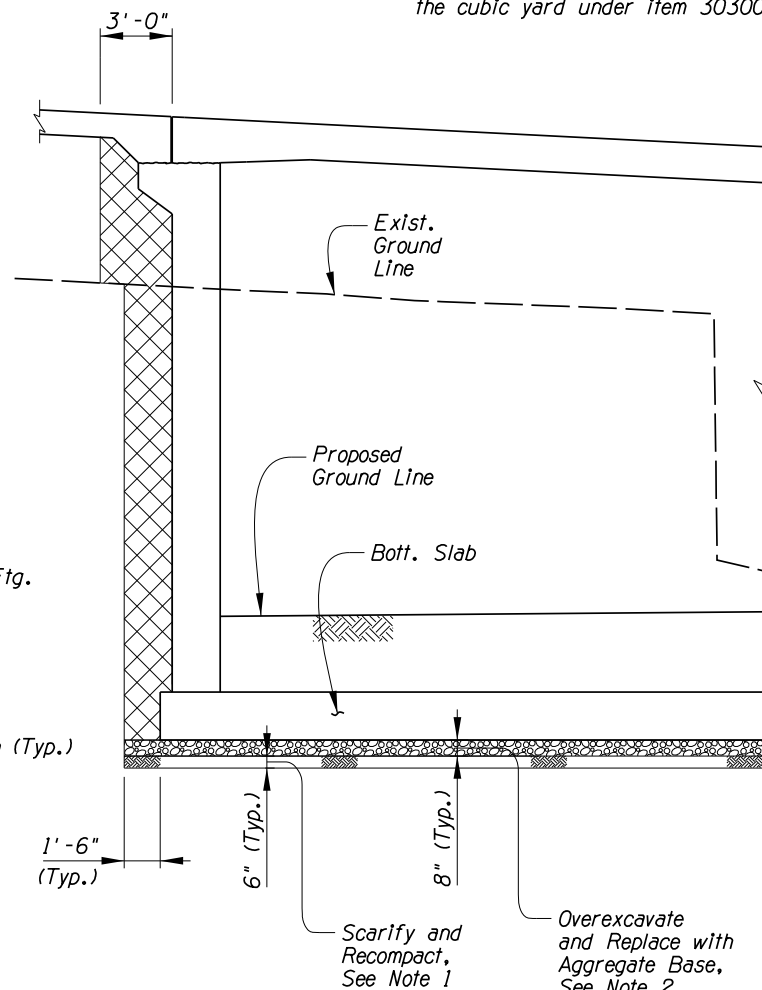
STRUCTURAL EXCAVATION LIMITS

Scale: 1/4" = 1'-0"

2



STRUCTURAL EXCAVATION - WINGWALL

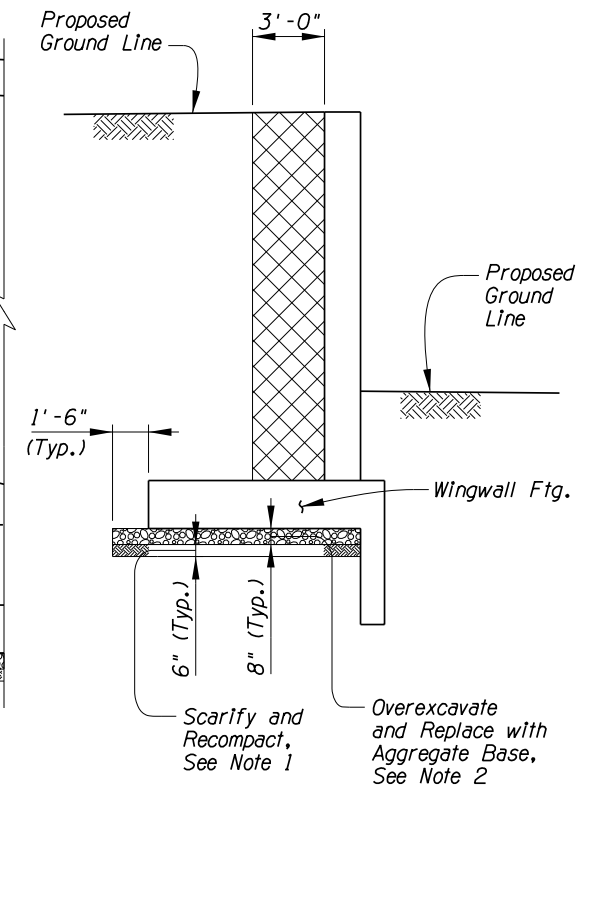


STRUCTURE BACKFILL - ABUTMENT

STRUCTURE BACKFILL LIMITS

Scale: 1/4" = 1'-0"

3



STRUCTURE BACKFILL - WINGWALL

LEGEND:

- Structural Excavation
Structure Backfill

Notes:

- The top 6" of the soil at the bottom of the excavation shall be moisture-conditioned and compacted to a density of not less than 100% and within $\pm 2\%$ optimum moisture content of the maximum dry density as determined in accordance with the requirements of Arizona Test Method 225.
- Aggregate Base shall conform to Section 303 of the PAG Standard Specifications and shall be compacted to a density of not less than 100% and within $\pm 2\%$ optimum moisture content of the maximum dry density as determined in accordance with the requirements of Arizona Test Method 225.
- Structural excavation, overexcavation, structure backfill, and scarification and recompactation are not direct pay items in this contract and shall be considered incidental to the bridge construction. Aggregate Base Course shall be paid for by the cubic yard under item 3030003.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0121310			
T0540.01C					

Kathryn Skinner, P.E., Director

Date	06/2025
Designed	GWS
Drawn	TRK
Checked	DL
Proj. Engr.	TWB

No.	Revision	Description	Engineer	Date

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Construction
or Recording

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MADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADFL

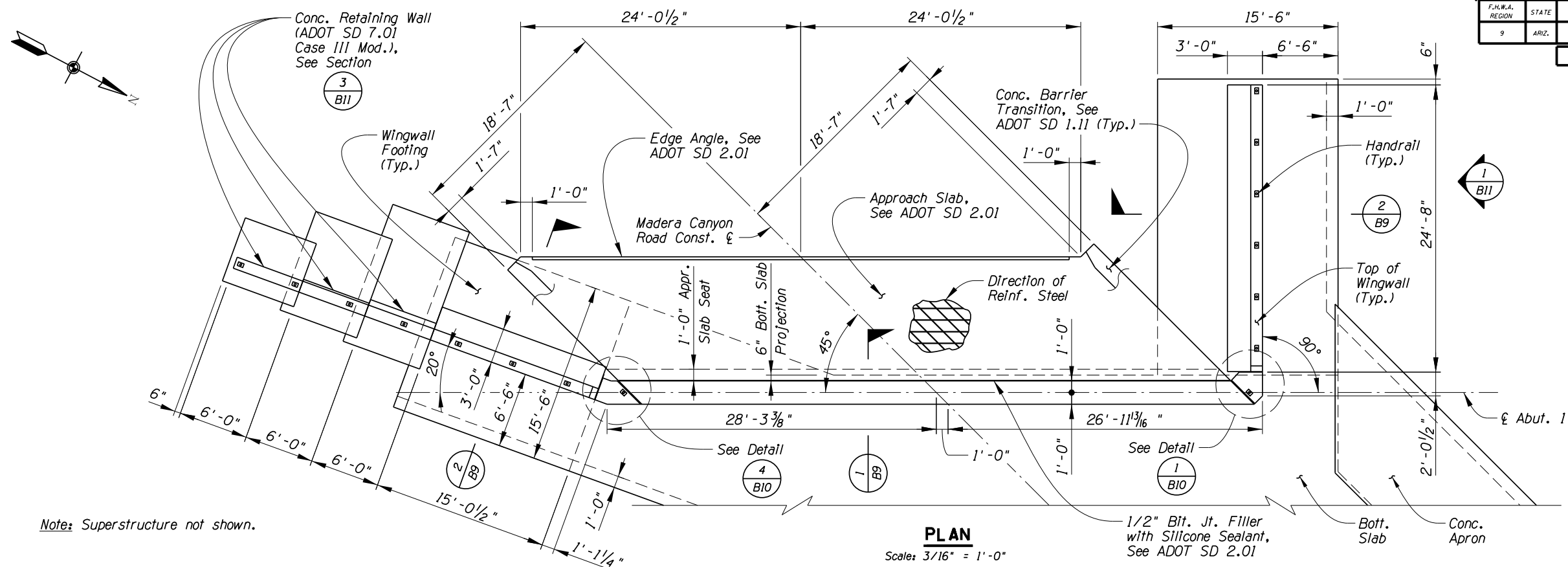
Pima County Department of Transportation

Madera Canyon Road, Florida Canyon Wash Bridge Replacement (4MADFL)

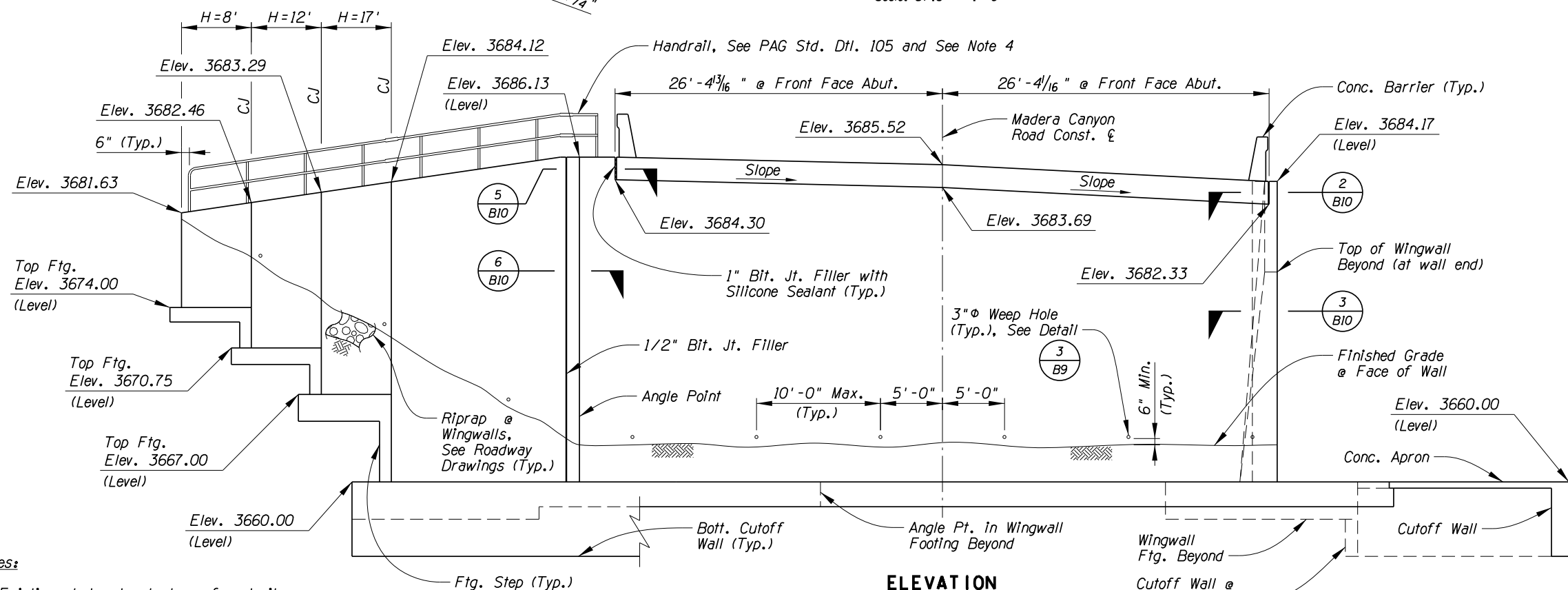


EXCAVATION & BACKFILL

Scales	Horiz.	Sheet B4 of B15	Page 31 of 70
	Vert.		



Note: Superstructure not shown.



Notes:

1. Existing abutment not shown for clarity.
2. Elevations are provided at abutment centerline and front face of wingwall.
3. CJ = Construction Joint. See ADOT SD 7.01 Sheet 2 of 5 for CJ details (sim.).
4. For PAG Std. Dtl. 105, place lower rail in Alternate Location and use End Treatment A at end of wall and End Treatment B adjacent to concrete bridge barrier. Provide angle point in handrail at top of wall near joint between wingwall and abutment wall, to match into end post on abutment.

ELEVATION
(Looking Back Station)
Scale: $3/16" = 1'-0"$



ABUTMENT 1 PLAN & ELEVATION

Scales	Horiz.	Sheet B7 of B15	Page 34 of 70
	Vert.		

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0127310			
		T0540 OIC			

		Date
Designed	GWS	06/2025
Drawn	TRK	06/2025
Checked	DL	06/2025
Proj. Engr.	TWB	06/2025

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**INITIAL
PS&E
SUBMITTAL**

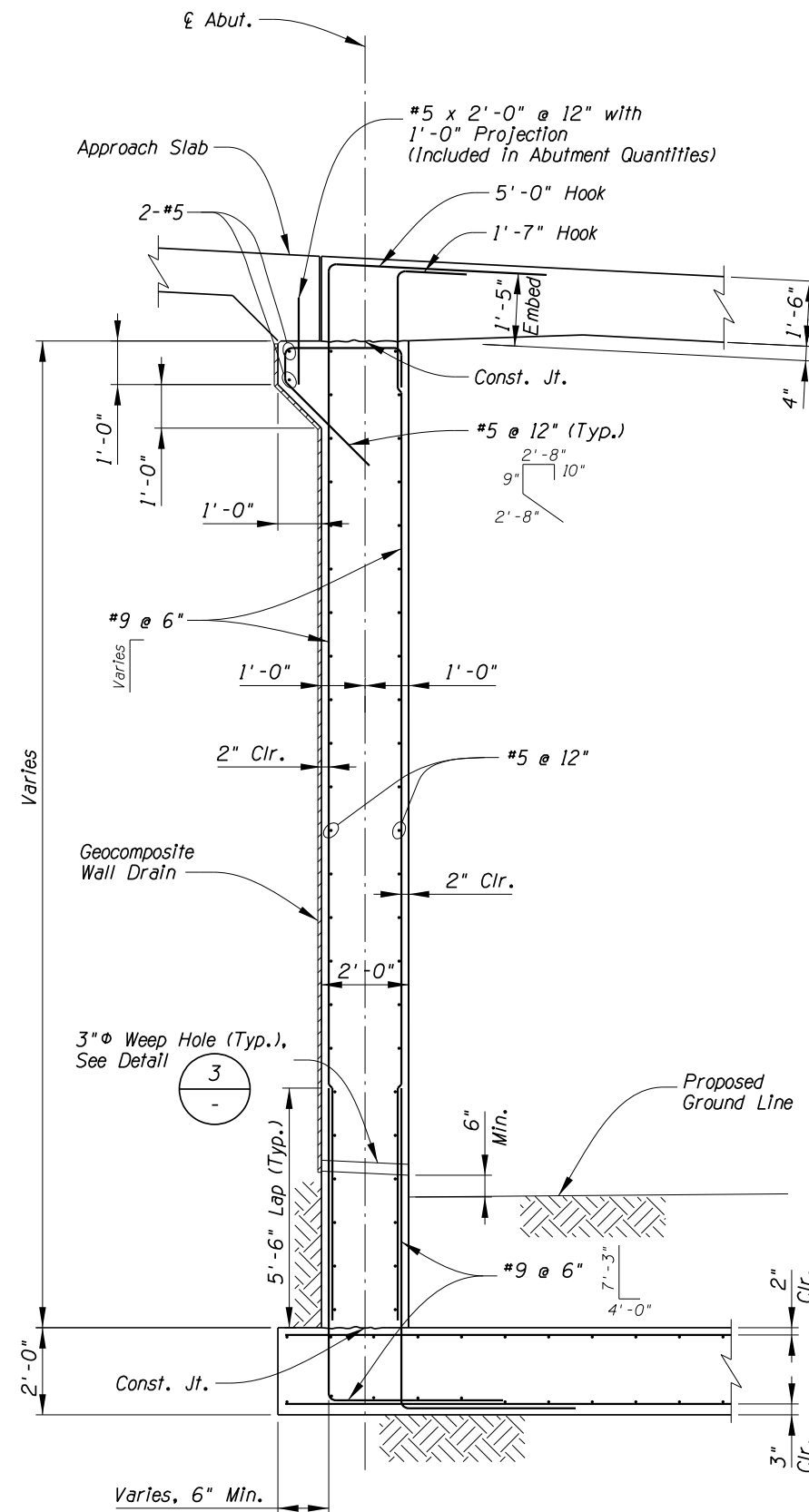


MMADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADFL

Kathryn Skinner, P.E., Director

Pima County Department of Transportation

Madera Canyon Road, Florida Canyon Wash Bridge Replacement (4MADFL)



F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-O(273)D			
T0540 OIC					

		Date
Designed	GWS	06/2025
Drawn	TRK	06/2025
Checked	DL	06/2025
Proj. Engr.	TWB	06/2025

No.	Revision	Description	Engineer	Date

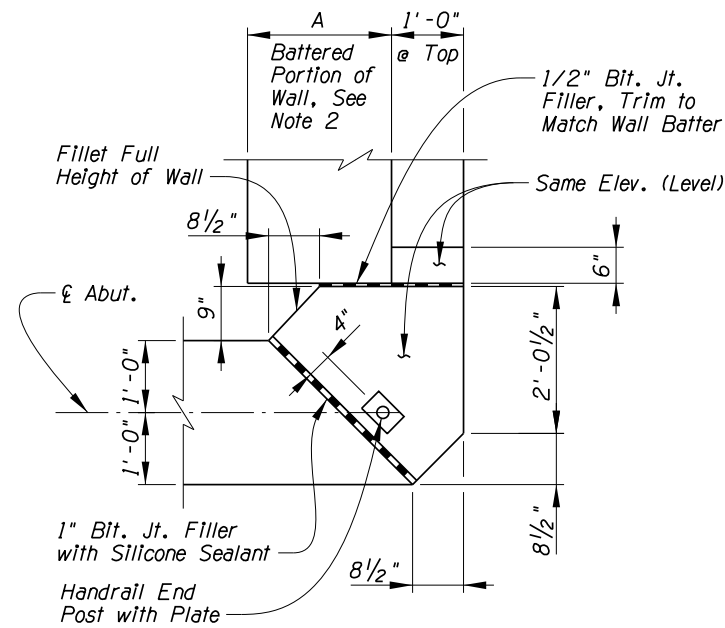
Kathryn Skinner, P.E., Director

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Construction
or Recording

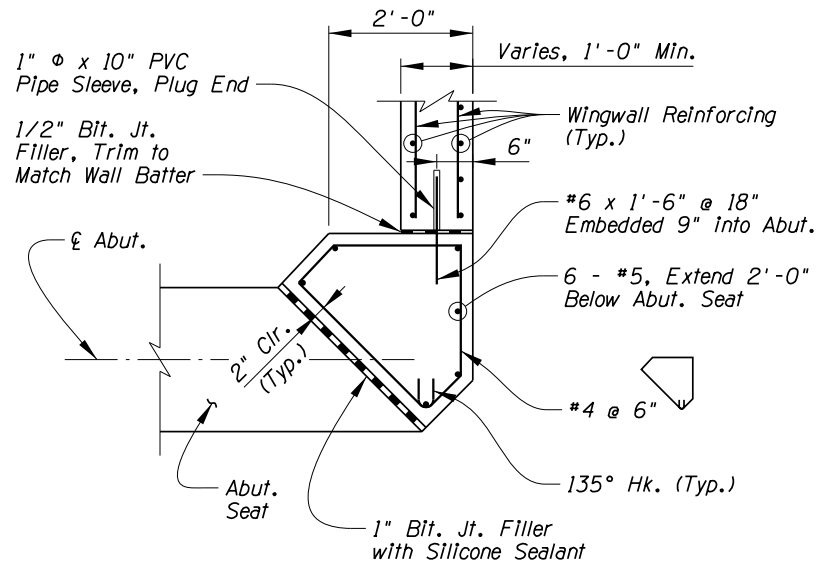
**MADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADFL**

Pima County Department of Transportation

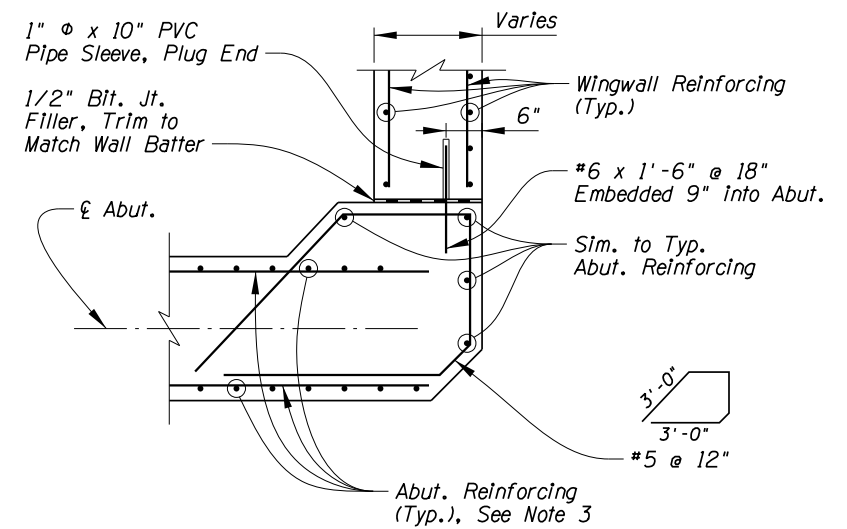
Madera Canyon Road, Florida Canyon Wash Bridge Replacement (4MADFL)



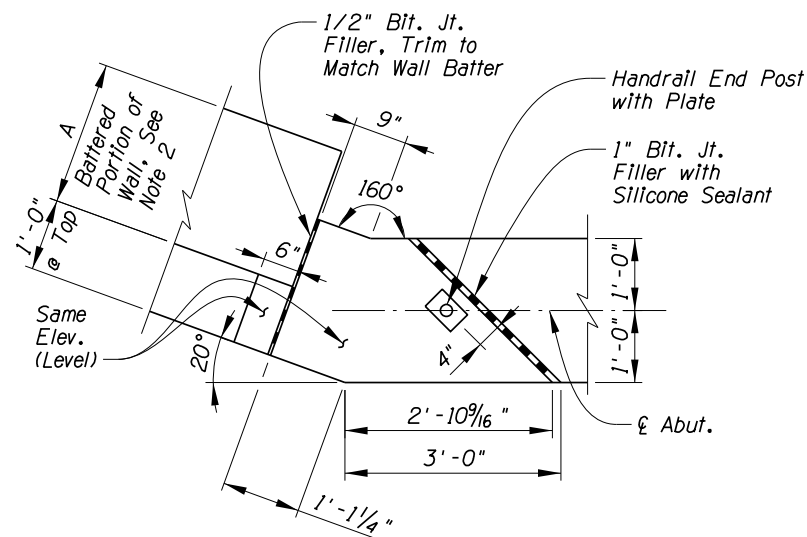
DETAIL 1
Scale: 3/4" = 1'-0"



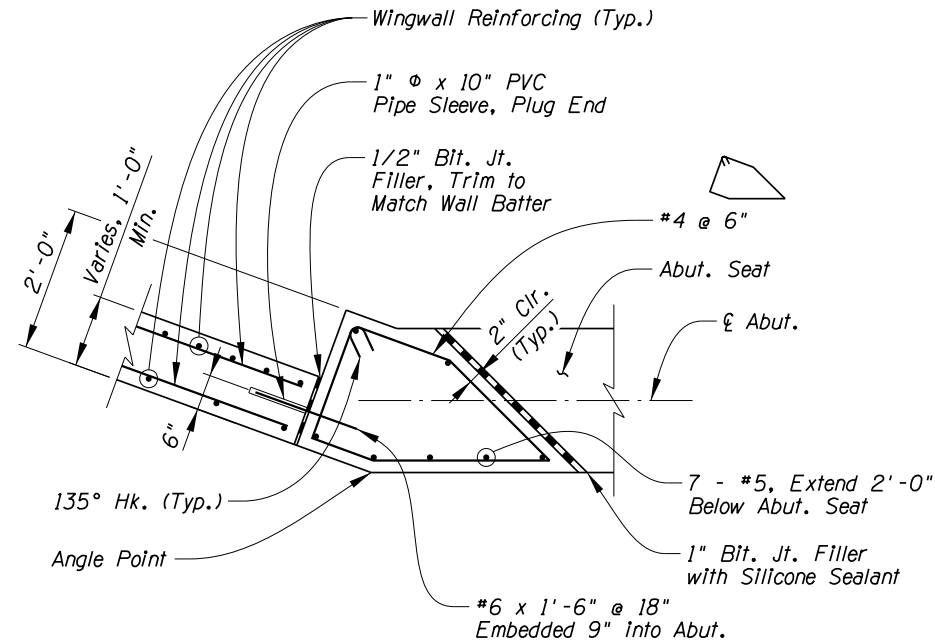
SECTION 2
Scale: $3/4" = 1'-0"$



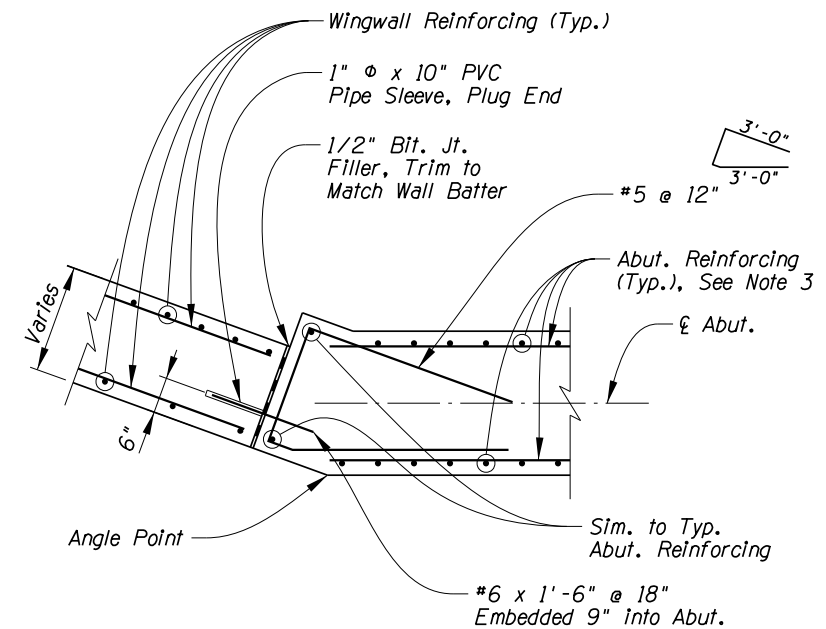
SECTION 3
Scale: $3/4" = 1' - 0"$



DETAIL 4
Scale: $\frac{3}{4}" = 1'-0"$



SECTION 5
Scale: 3/4" = 1'-0"



SECTION 6
Scale: $3/4" = 1'-0"$

Notes:

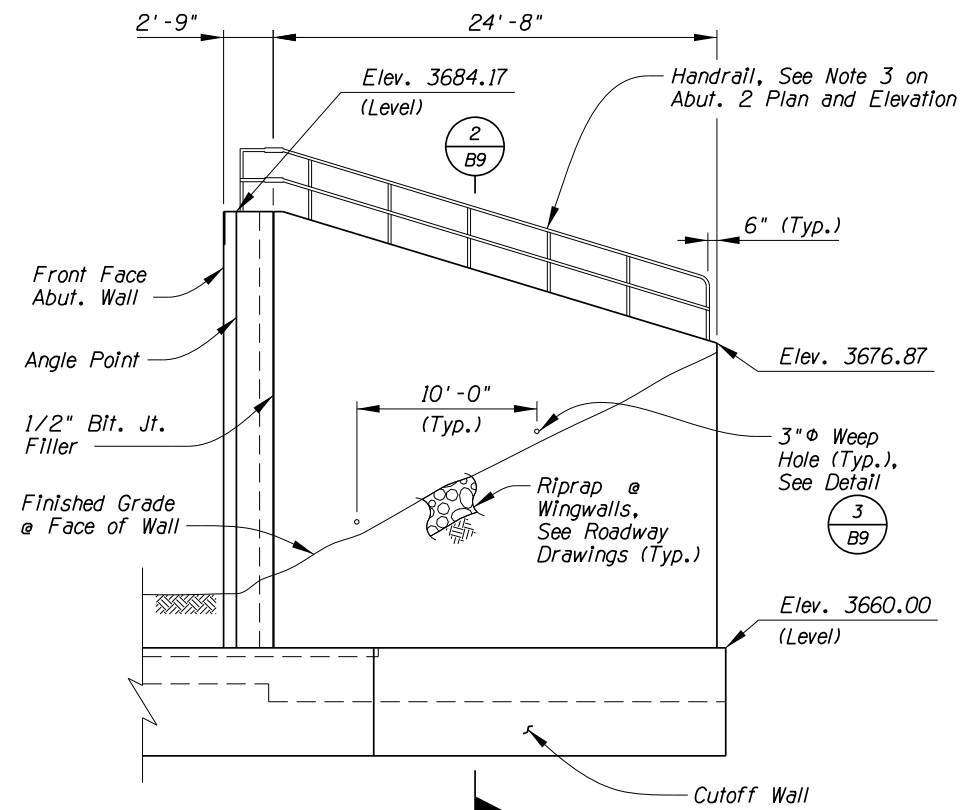
1. Approach slab and approach slab seat not shown.
2. A = 0'-0" @ Top of Wall
 = 2'-0" @ Bott. of Wall @ Abut. 1
 = 0'-10" @ Bott. of Wall @ Abut. 2
3. Typical vertical abutment reinforcing to hook into deck slab, except beyond edge of deck where it terminates with no hook at abutment seat.



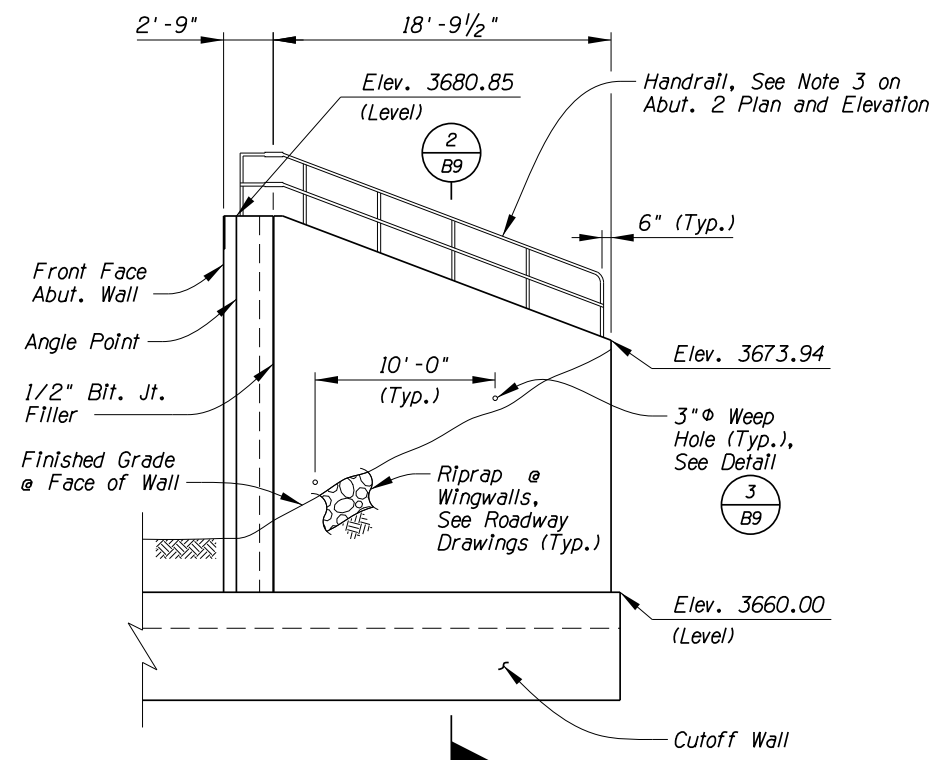
ABUTMENT & WINGWALL DETAILS 2

Scales	Horiz.	Sheet B10 of B15	Page 37 of 70
	Vert.		

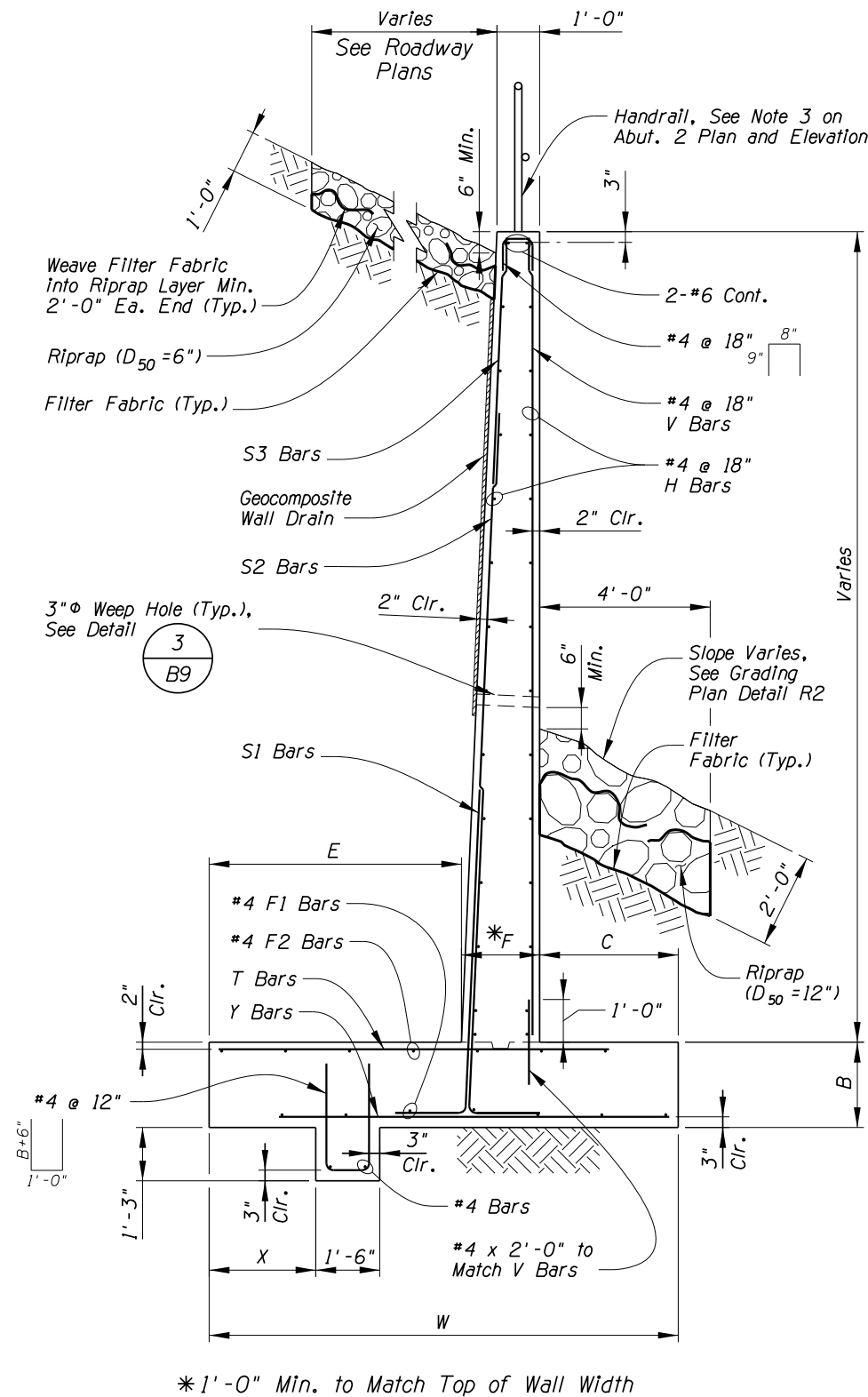
Project ID: 10416569
Client Number: 4108
Pentable: COTPMALPLOT000R.TBL
PlotDriver: 10416569_Ventil-B&W_PDF.plt



WINGWALL ELEVATION (ABUT. 1 WEST) 1
Scale: 3/16" = 1'-0"



WINGWALL ELEVATION (ABUT. 2 EAST) 2
Scale: 3/16" = 1'-0"



TYPICAL RETAINING WALL SECTION 3
Scale: 1/2" = 1'-0"

Notes:

1. Conc. retaining walls, including construction joints and footing steps, to be constructed in accordance with ADOT SD 7.01 Case III - 2:1 (Max) Sloping Fill. Modify dimensions as shown in Section 3 on this sheet. Concrete shall be Class S, $f'c=3000$ psi @ 28 days.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0121310			
T0540.01C					

Kathryn Skinner, P.E., Director

Date	Designed	Drawn	Checked	Proj. Engr.
06/2025	GWS	TRK	DL	TWB
06/2025				
06/2025				

No.	Revision	Description	Engineer	Date

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Not For
Construction
or Recording

HCR

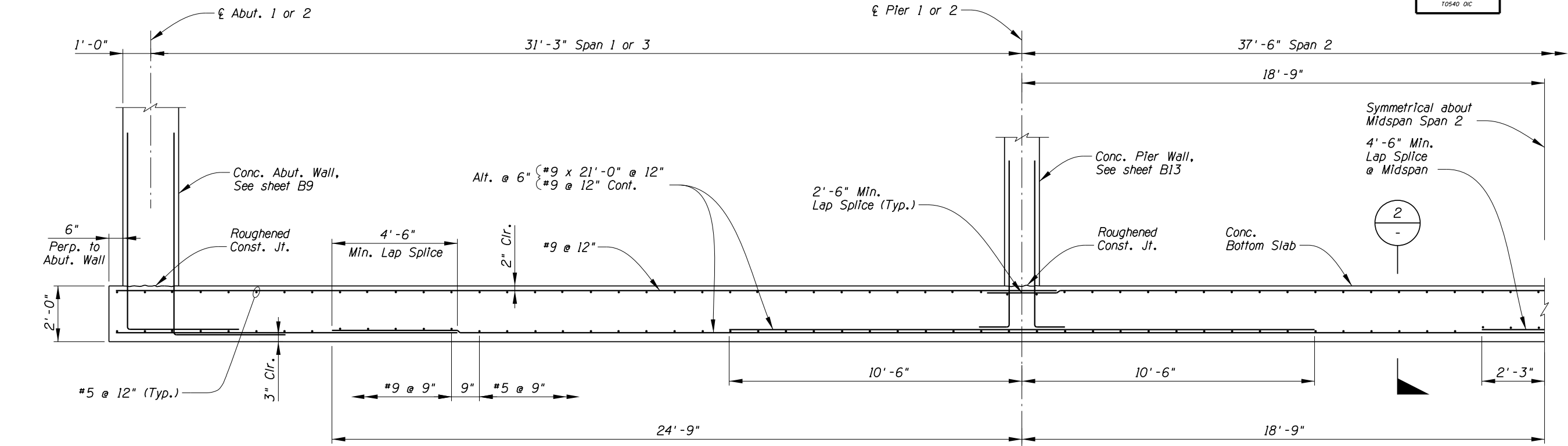
MADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADFL

Pima County Department of Transportation



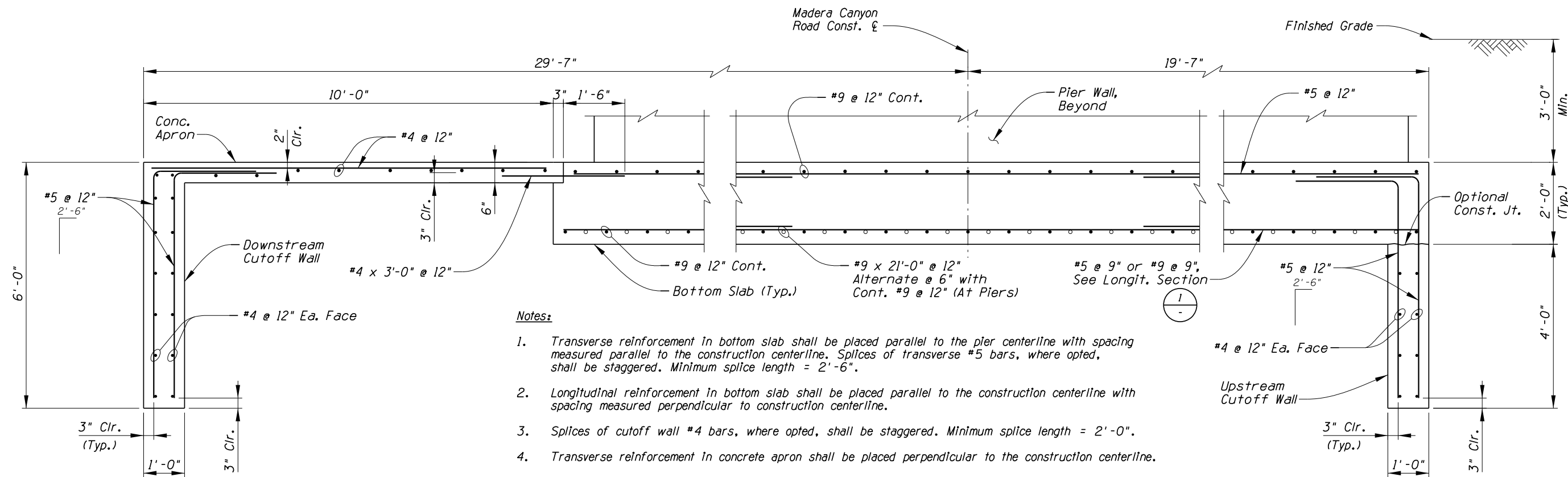
ABUTMENT & WINGWALL DETAILS 3

Project ID: 10416569
Client Number: 4108
Pentable: COTPMALPLOT000R.TBL
Plotdriver: 10416569_Ventil-B&W_PDF.plt



BOTTOM SLAB LONGITUDINAL SECTION

Scale: 1/2" = 1'-0"



Notes:

- Transverse reinforcement in bottom slab shall be placed parallel to the pier centerline with spacing measured parallel to the construction centerline. Splices of transverse #5 bars, where opted, shall be staggered. Minimum splice length = 2'-6".
- Longitudinal reinforcement in bottom slab shall be placed parallel to the construction centerline with spacing measured perpendicular to construction centerline.
- Splices of cutoff wall #4 bars, where opted, shall be staggered. Minimum splice length = 2'-0".
- Transverse reinforcement in concrete apron shall be placed perpendicular to the construction centerline.

BOTTOM SLAB SECTION

(Looking Ahead Station)

Scale: 1/2" = 1'-0"



BOTTOM SLAB DETAILS

Scales Horiz. Vert. Sheet B12 of B15 Page 39 of 70

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0121310			
T0540 DIC					

Kathryn Skinner, P.E., Director

Date	Designed	Drawn	Checked	Proj. Engr.
06/2025	GWS	TRK	DL	TWB
06/2025				
06/2025				

No.	Revision	Description	Engineer	Date

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Not For
Construction
or Recording

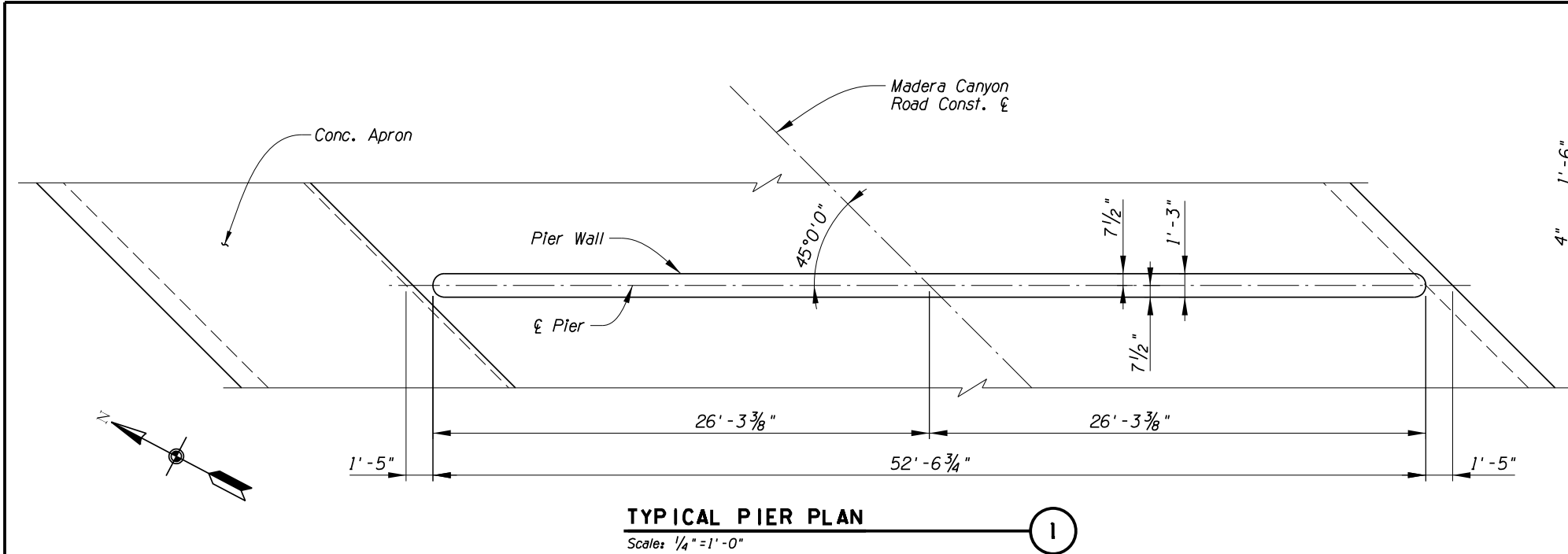
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MADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MA0FL

Pima County Department of Transportation

Madera Canyon Road, Florida Canyon Wash Bridge Replacement (4MA0FL)

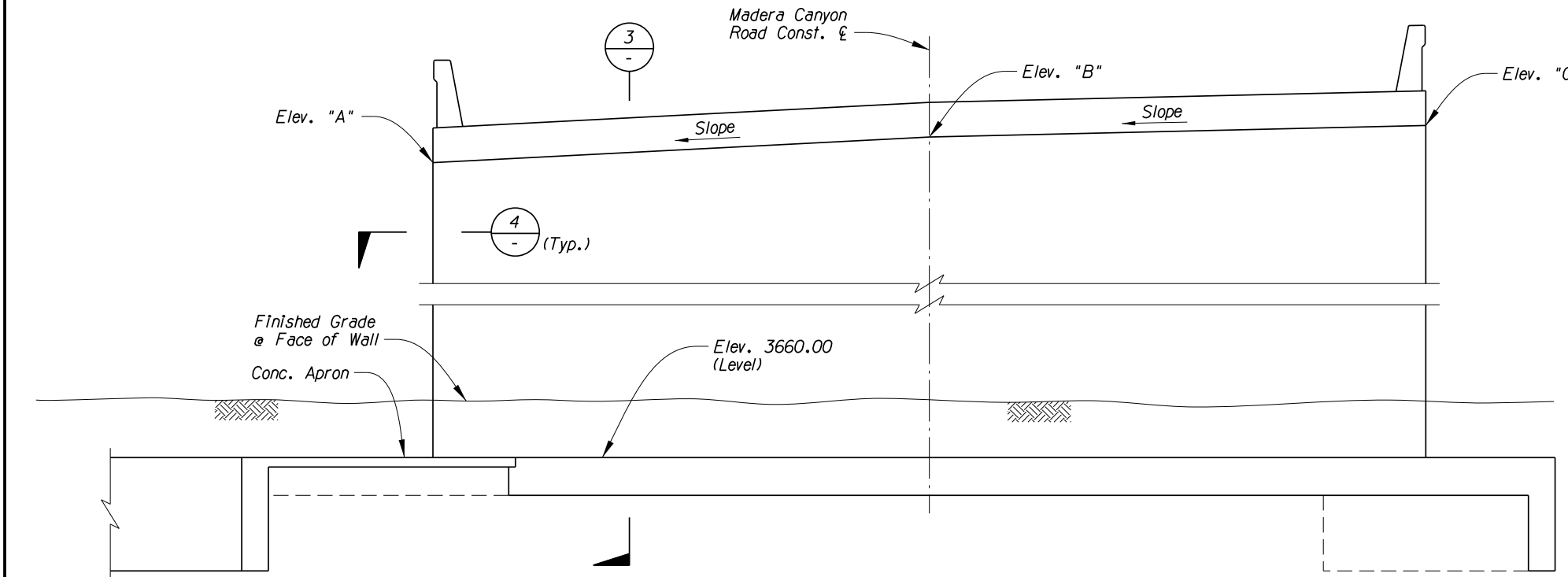
Project ID: 10416569
Client Number: 4108
Pentable: COTPMALPLOT000R.TBL
PlotDriver: 10416569_Ventail-B&W_PDF.plt



TYPICAL PIER PLAN

Scale: 1/4" = 1'-0"

1



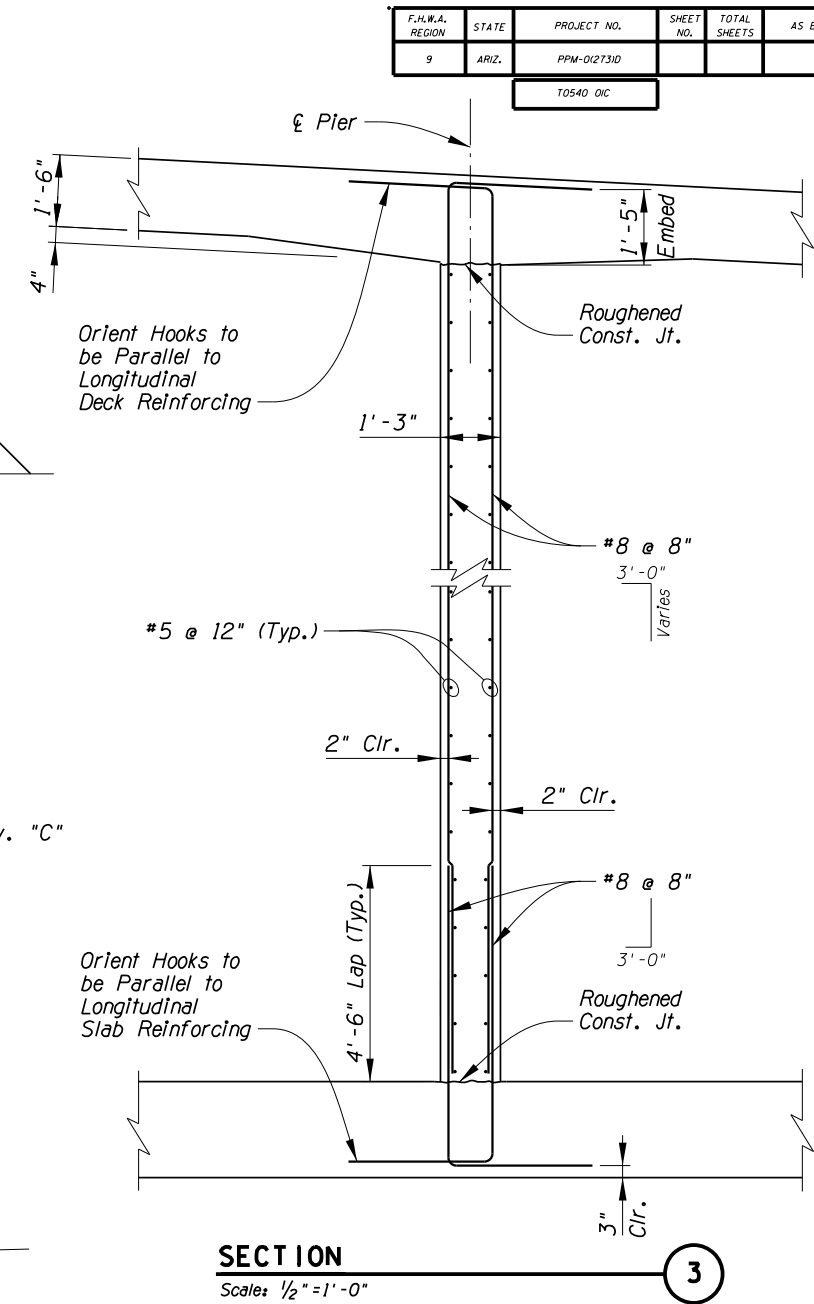
TYPICAL PIER ELEVATION

(Looking Ahead Station)
Scale: 1/4" = 1'-0"

2

TABLE OF ELEVATIONS*			
	Elev. "A"	Elev. "B"	Elev. "C"
Pier 1	3680.68	3682.04	3682.65
Pier 2	3678.70	3680.06	3680.67

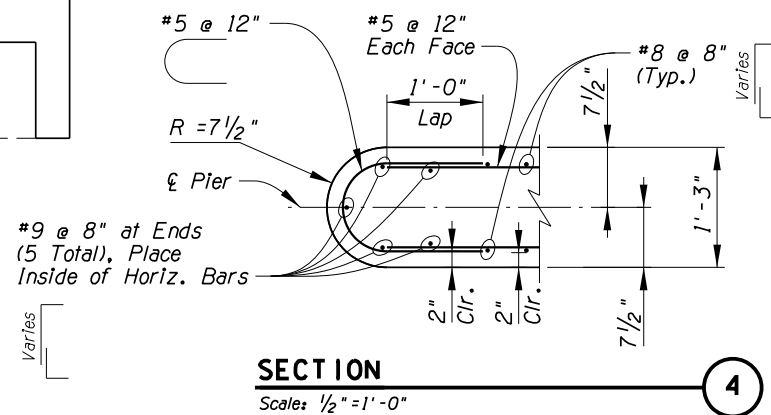
*Elevations shown are at ξ pier at bottom of deck.



SECTION

Scale: 1/2" = 1'-0"

3



SECTION

Scale: 1/2" = 1'-0"

4



PIER DETAILS

Kathryn Skinner, P.E., Director

Date	Designed	Drawn	Checked	Proj. Engr.
06/2025	GWS	TRK	DL	TWB
06/2025				
06/2025				

No.	Revision	Description	Engineer	Date

INITIAL
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Construction
or Recording

FOR

MADERA CANYON ROAD
FLORIDA CANYON WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MA0FL

Pima County Department of Transportation

Madera Canyon Road, Florida Canyon Wash Bridge Replacement (4MA0FL)



MADERA CANYON ROAD

Medium Wash Bridge Replacement

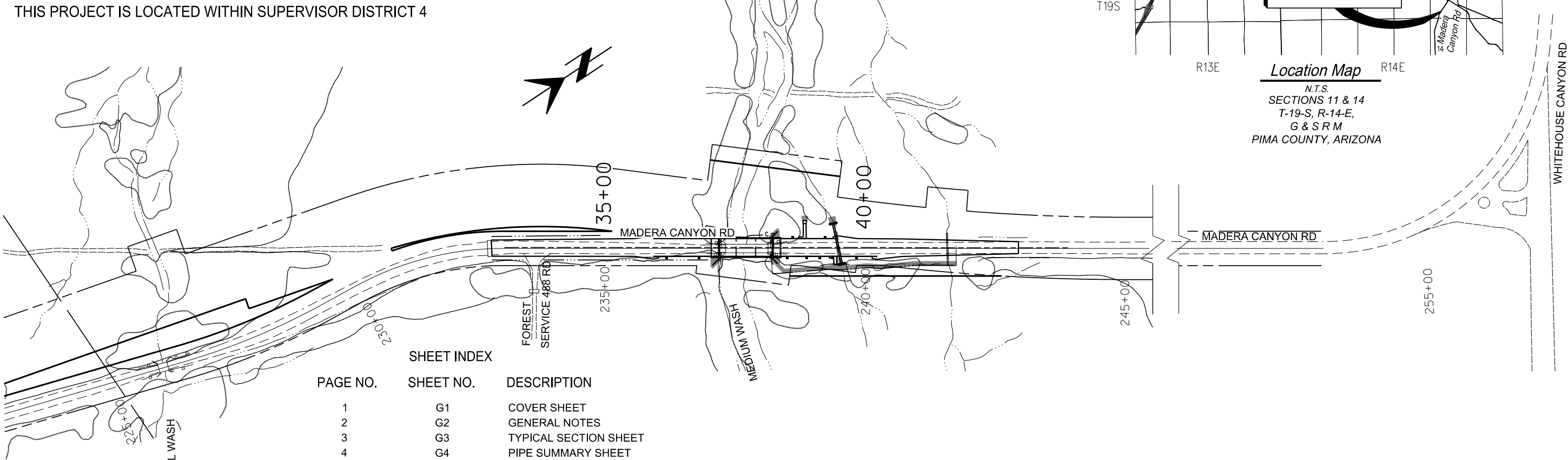
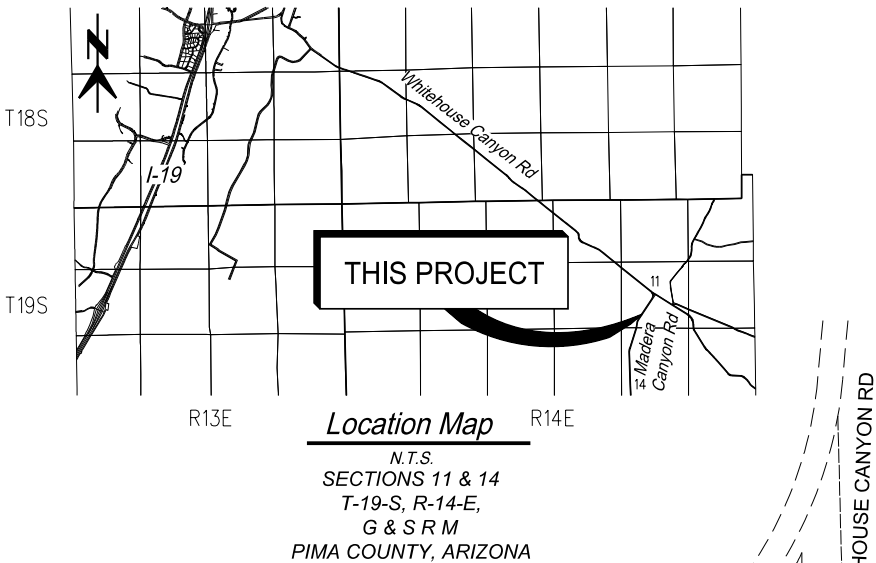
FEDERAL PROJECT NO. PPM - 0(274)D



GENERAL DESCRIPTION OF PROJECT

The proposed scope of work for this project includes the removal of existing concrete slab bridge, construction of a new bridge with bank protection, asphalt concrete surface roadway, and other incidental items.

ADOT PROJECT NUMBER T0541
PIMA COUNTY PROJECT NUMBER 4MADBR



SHEET INDEX		
PAGE NO.	SHEET NO.	DESCRIPTION
1	G1	COVER SHEET
2	G2	GENERAL NOTES
3	G3	TYPICAL SECTION SHEET
4	G4	PIPE SUMMARY SHEET
5	G5	BARRIER SUMMARY SHEET
6 - 7	G6-G7	GEOMETRIC LAYOUT SHEETS
8 - 9	R1 - R2	ROADWAY PLAN & PROFILE SHEETS
10 - 15	RD1 - RD6	ROADWAY DETAILS (R-Series)
16 - 21	SM1 - SM6	PAVEMENT MARKING & SIGNING SHEETS
22 - 34	B1 - B13	BRIDGE PLAN SHEETS
35	ECN1	EROSION CONTROL NOTES
36 - 39	ECD1 - ECD4	EROSION CONTROL DETAILS
40 - 41	EC1 - EC2	EROSION CONTROL PLAN SHEETS
42	LPN1	LANDSCAPE MITIGATION NOTES
43	LPD1	LANDSCAPE MITIGATION DETAILS
44 - 45	LP1 - LP2	LANDSCAPE MITIGATION PLAN SHEETS
46 - 50	NPIN01 - NPIN03	NATIVE PLANT INVENTORY SHEETS

INITIAL PS&E SUBMITTAL
NOVEMBER 2025



No.	Revisions	Engineer	Date
No.	As Built	Engineer	Date

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NOT FOR
CONSTRUCTION
OR RECORDING

Pima County
Department of Transportation
201 N. Stone Ave. 4th Floor
Tucson, Arizona 85701
Phone Number: 520-724-6410
Kathryn Skinner, P.E., Director

Approved: _____ 20__

Kathryn Skinner, P.E.

Project No. 4MADBR

Sheet No. G1 of G7

Page No. 1 of 50

Printed By: JORICHTER

Date: 11/23/2025 5:34:33 PM

Print Scale: 1:200

Project ID: 10416569
Client Number: 4108
PenTable: COTPA_PL010RDR.TBL
PlotDriver: 10416569_V8Plot_BW_PDF.plt



ProjectWise Directory: \Model: Default

Madera Canyon Road, Medium Wash Bridge Replacement (4MADBR)

Project ID: 10416569
Client Number: 4108
PenTable: COTMA_PL010RDR.TBL
PlotDriver: 10416569_V8Plot_BkW_PDF.plt

GENERAL NOTES

1. Construction shall be in conformance with the specifications and details listed in the special provisions.
2. Utility locations shown on plans were compiled based on the best information available to the Department, utility locations are not intended to be exact or complete. Prior to commencing construction, the Contractor shall verify the location of all utilities with the appropriate organizations. Contact "Blue Stake" at 1-800-782-5348, two full working days prior to beginning construction (Saturdays and Sundays are not considered working days).
3. Right-of-Way Encroachments shall be removed only by order of Pima County, unless noted.
4. Removal of all cacti and native plants shall be in accordance with the provisions of the "Arizona Native Plant Law" A.R.S., Chapter 7 and Pima County Native Plant Preservation Ordinance Title 18 Chapter 18.72.
5. The Basis of Bearing for this project, N89°30'06"E, was derived using the Arizona Coordinate System, North American Datum (NAD) 1983 (1992), Central Zone 0202, in International feet, and observed between Pima County Control Pt. *3663 (BM *2, a found 3-1/8" brass disk in concrete headwall at the northeast corner of the bridge over Medium Wash) to Pima County Control Pt. *3674 (BM *3, a found 3-1/8" brass disk in concrete headwall at the northeast corner of the bridge over Florida Canyon Wash). Said basis of bearing = South 19°53'16.3" West. Said bearing established on P.C.H.D. Projects 4MCAMW and 4MCAFW and recorded Survey Book 26 Page 10 (Seq. 20021010193) at the Pima County Recorder's Office.
6. The Basis of Elevation originated from Pima County bench mark P399 (A found 3-1/2" brass disk in 1" concrete cylinder). Said bench mark is located at the southwest corner of Madera Canyon Road and Whitehouse Canyon Road with an elevation of 3677.62 feet (NAVD-88) according to P.C.H.D. Projects 4MCAMW and 4MCAFW and recorded Survey Book 26 Page 10 (Seq. 20021010193) at the Pima County Recorder's Office.
7. The project surface coordinates are derived from state plane grid values by using the following formulas. A combined scale factor 0.999846886 was used to convert grid coordinates to project surface coordinates. Surface Northing and Easting coordinates are derived by dividing the grid coordinates by 0.999846886 and subtract 200,000 feet from project northings and subtract 1,000,000 feet from project eastings.
- | | Northing | Easting |
|-------------|--------------|----------------|
| *3663" Grid | 288,136.2340 | 1,020,749.1990 |
| Surface | 88,180.3644 | 20,905.5139 |
| *3674" Grid | 285,998.5790 | 1,019,975.8890 |
| Surface | 86,042.3761 | 20,132.0855 |
8. The Contractor shall maintain access to Forest Service Road 488 during construction. The Contractor will not restrict Emergency Vehicles, U.S. Postal Delivery, Solid Waste Collections, and/or access to the adjacent properties, except as approved by the Engineer.
9. Soils information will be made available to prospective bidders in the geotechnical report. Soils information so provided shall be for information purposes only. This information was developed as accurately as possible by the methods used. Pima County accepts no responsibility for any conditions encountered which vary from the information provided.
10. Existing topographic conditions shown on plan sheets reflect conditions as of August 10, 2000 and were generated by P.C.H.D. Projects 4MCAMW and 4MCAFW. Certain missing and match-in areas have been updated with recent verification and supplemental surveys.
11. Omissions or conflicts between various elements of the drawings, notes, and details shall be brought to the attention of the Engineer and resolved before proceeding with the work.
12. All stationing shown on the plans is based upon the centerline as noted. See Geometric Layout Sheets.
13. Existing utilities include, but may not be limited to, overhead and underground electric, communication, and irrigation, and shall be moved by others unless otherwise noted and shown in these plans.
14. The current regulatory posted speed limit is 45 MPH with 25 MPH advisory speeds throughout the length of the project. The design speed is: 45 MPH.
15. The horizontal control and right-of-way lines for this project are based upon information provided on this project Right of Way Plan Sheets.
16. The Basis of Stationing for the Existing R/W Centerline was determined from found centerline point of intersection monuments and their reference markers along with PCDOT alignment study and field notes performed by Walter Burg County Engineer in 1961 project number R-AD-16(4).

17. The Basis of Stationing for the Existing Survey Centerline was determined from found R/W markers established by and according to PCDOT project numbers 4MCAMW & 4MCAFW and ADOT project numbers 0000 PM PPM SB405 OIC & 0000 PM PPM SB406 OIC which was filed as a Record of Survey at the Pima County Recorder's office at Book 26 Pg 10 also known as Sequence 20021010193.

TRAFFIC DATA

Madera Canyon Road	2025 ADT 537	2040 ADT 740
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LENGTH OF PROJECT

STA. 33+10.00 to STA 43+00.00 = 990' = 0.188 miles

EARTHWORK NOTES

1. For estimating purposes, earthwork quantities assume that all on-site materials are not acceptable for use as pipe bedding, pipe backfill, and structure backfill.
2. For estimating purposes, earthwork quantities assume existing pavement, borrow excavation, detour excavation, and pipe excavation are acceptable for use as roadway embankment. All other structural excavation is assumed not acceptable for use as roadway embankment without additional processing.
3. Roadway Embankment volume includes Riprap along bridge headwalls and roadway embankment fill slopes. For Net Embankment Demand, Riprap volume is subtracted out.
4. To meet the Net Embankment Demand, on-site material from the Florida Canyon Wash detour and borrow excavation and are paid for under Florida Canyon Wash Bid Item 2030300 & 2030301.

EARTHWORK QUANTITIES

Item No.	Item Description	Total
EXCAVATION		
2020029	Existing Pavement Removal	183 C.Y.
2030300	Roadway Excavation	243 C.Y.
	Pipe Excavation	70 C.Y.
	Structural Excavation	2,990 C.Y.
	Available Excavation (See Note 2)	313 C.Y.
	Shrink (10%)	32 C.Y.
	Net Available Excavation	281 C.Y.
EMBANKMENT		
	Roadway Embankment (See Note 2 & 3)	2,545 C.Y.
	Ground Compaction (0.1')	134 C.Y.
9130015	Riprap (D ₅₀ =6") (See Note 3)	130 C.Y.
9130016	Riprap (D ₅₀ =12") (See Note 3)	80 C.Y.
	Net Embankment Demand (See Note 3 & 4)	2,197 C.Y.
2030901	Borrow	0 C.Y.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0127410	2		
T0541 OIC					

Contact Arizona 811 at least two full working days before you begin excavation
Call 811 or click Arizona811.com

GENERAL NOTES

Scales	Horiz. NTS Vert. NTS	Sheet G2 of G7	Page 2 of 50
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Kathryn Skinner, P.E., Director

Date	JAR/TCC	JAR/TCC	JAR/TCC	JAR/TCC
11/23/2025				
11/23/2025				
11/23/2025				
11/23/2025				

No.	Revision	Description	Engineer	Date

INITIAL
PS&E
SUBMITTAL
Not For
Construction
or Recording

FOR

MADERA CANYON ROAD
MEDIUM WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADBR

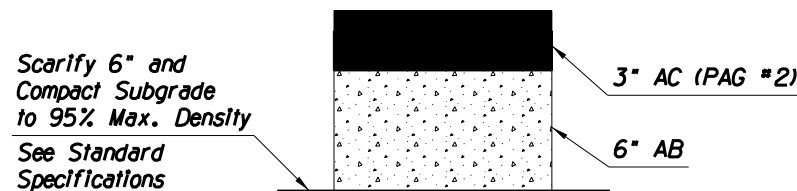
Madera Canyon Road, Medium Wash Bridge Replacement (4MADBR)

ABBREVIATIONS NOT INCLUDED
IN PAG STD. DTL. 101

Aluminum Cap on Pipe	A.C.P.
Abandoned	Aband.
Arizona Department of Transportation	ADOT
Control	Ctrl.
Correction	Corr.
Decomposed Granite	D.G.
Detail	Dtl.
Drainage Easement	D.E.
Edge Of Pavement	E.P.
General Land Office	G.L.O.
Intelligent Traffic System	ITS
Median	Med.
Pima Association of Governments	PAG
Point Of Beginning	P.O.B.
Point Of End	P.O.E.
Point of Information	P.O.I.
Raised Pavement Marker	R.P.M.
Shoulder	Shldr.
Standard	Std.
Stopping Sight Distance	SSD
Temporary Construction Easement	T.C.E.
Vertical Curve	V.C.

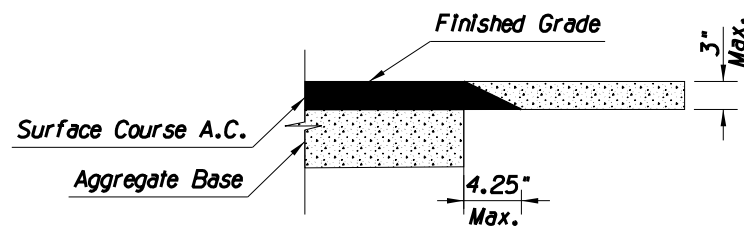
PLAN SYMBOLS NOT INCLUDED
IN PAG STD. DTL. 100

New Barb Wire Game Fence	X X X
New R/W	—
Potential Borrow & Staging Area	—



Pavement Structure No. 1

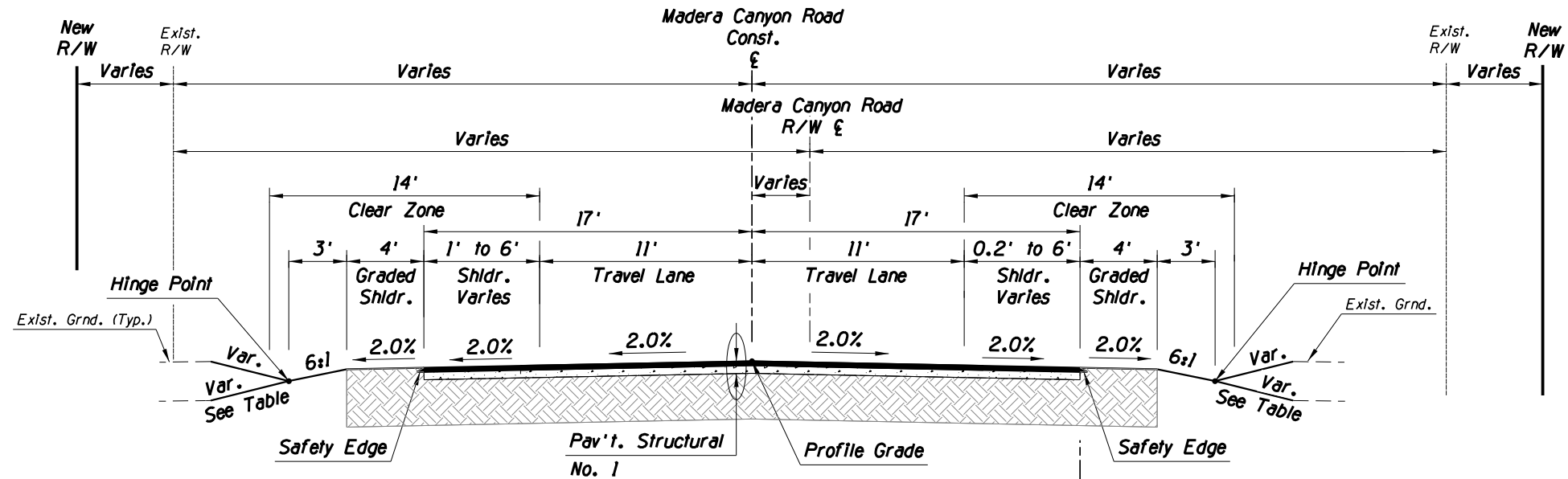
Madera Canyon Rd Sta. 32+85 to Sta. 43+00
NOT TO SCALE



Safety Edge Detail

NOT TO SCALE

MEDIUM WASH SLOPE TABLE					
LEFT			RIGHT		
Start Sta.	End Sta.	Slope	Start Sta.	End Sta.	Slope
32+85	37+00	4:1 Cut/Fill	32+85	34+50	4:1 Cut/Fill
37+10	37+26 (Bridge)	2:1 Fill	34+60	35+50	3:1 Cut
38+24 (Bridge)	38+50	2:1 Fill	35+60	37+00	4:1 Cut/Fill
38+60	End	4:1 Fill	37+10	37+26 (Bridge)	2:1 Fill
			38+24 (Bridge)	38+40	2:1 Fill
			38+50	39+50	3:1 Fill
			40+00	41+00	4:1 Fill
			41+35	41+80	6:1 Max. Fill
			41+80	End	4:1 Fill

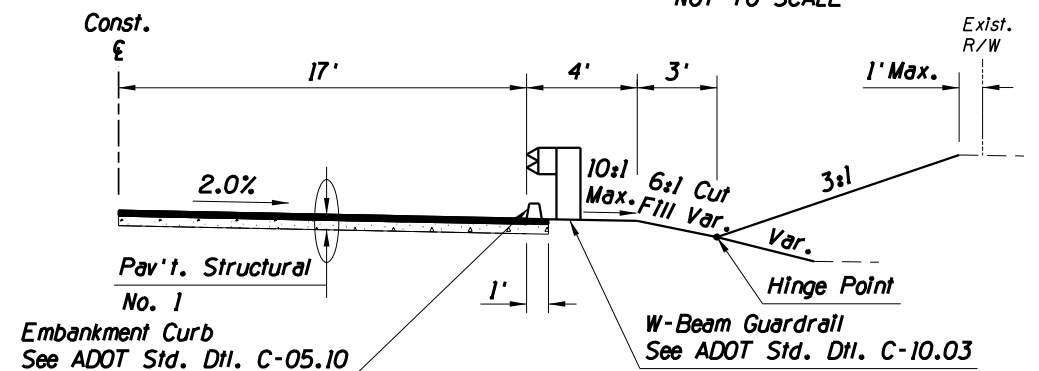


Madera Canyon Road

Sta. 32+85 to Sta. 37+09
Sta. 38+41 to Sta. 43+00
NOT TO SCALE

Note: All Lane Dimensions are Measured from the Center of Lane Line, Center of Double Lane Line, or Edge of Pavement, Unless otherwise noted.

Note: See Bridge Sheets for Bridge Typical Section.
Note: See Roadway Plan Sheets for pavement (shoulder) taper stationing and widths



Typical Half-Section @ Guardrail

Symmetric About Const. ϵ
NOT TO SCALE

TYPICAL SECTION

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-012741D			
T0541.DIC					



Kathryn Skinner, P.E., Director

Date	11/2025	11/2025	11/2025
Designed	JAR/TCC	JAR/TCC	JAR/TCC
Drawn	JAR/TCC	JAR/TCC	JAR/TCC
Checked	JAR/TCC	JAR/TCC	JAR/TCC
Proj. Engr.	JAR/TCC	JAR/TCC	JAR/TCC

No.	Revision	Description	Engineer	Date

INITIAL
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or Recording

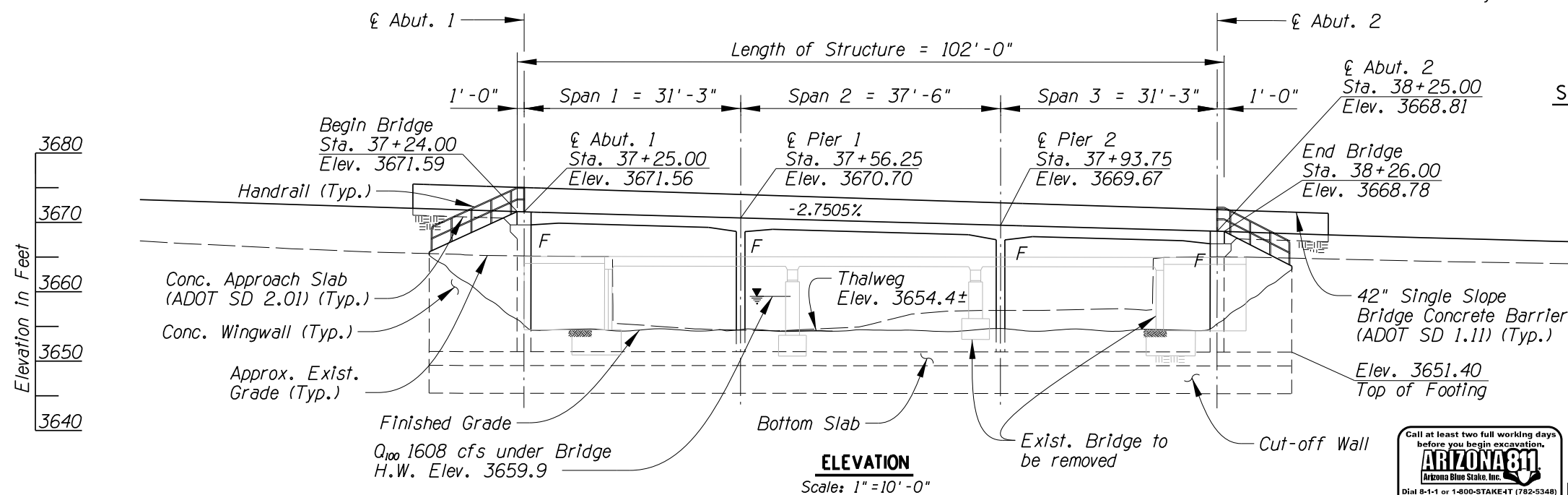
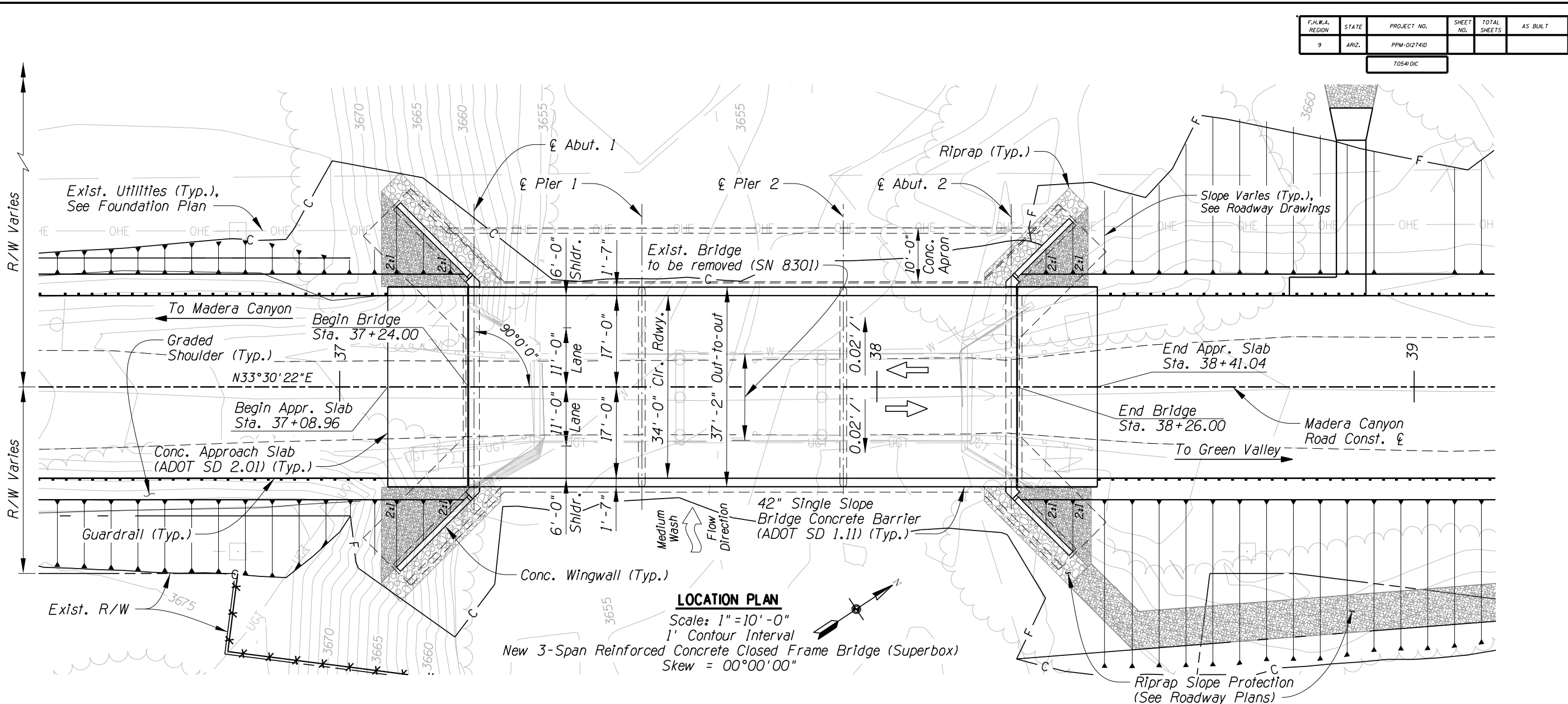
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MADERA CANYON ROAD
MEDIUM WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADBR

Pima County Department of Transportation

Madera Canyon Road, Medium Wash Bridge Replacement (4MADBR)

Project ID: 10416569
Client Number: 4108
Pentable: C:\PMA-PL\ORDR.TBL
Plotdriver: 10416569_Vehic_B&W_PDF.plt



SHEET INDEX	
SHEET NO.	TITLE
B1	Plan & Elevation
B2	Typical Section & Quantities
B3	General Notes
B4	Excavation & Backfill
B5	Foundation Plan & Notes
B6	Abutment Footing Details
B7	Abutment 1 Plan & Elevation
B8	Abutment 2 Plan & Elevation
B9	Abutment & Wingwall Details
B10	Bottom Slab Details
B11	Pier Details
B12	Deck Slab Details
B13	Camber & Screed Elevations



F.H.W.A. REGION

STATE

PROJECT NO.

SHEET NO.

TOTAL SHEETS

AS BUILT

9

ARIZ.

PPM-012141D

T0541.DIC

Date

06/2025

GWS

06/2025

TRK

06/2025

DL

06/2025

TWB

06/2025

Date

Engineer

Revision

Description

No.

INITIAL

PS&E

SUBMITAL

Not For Construction or Recording

Pima County Department of Transportation

MADERA CANYON ROAD

MEDIUM WASH

BRIDGE REPLACEMENT

PROJECT NO. 4MADBR

Kathryn Skinner, P.E., Director

Madera Canyon Road, Medium Wash Bridge Replacement (4MADBR)

GENERAL NOTES:

Design Specifications

AASHTO LRFD Bridge Design Specifications, 9th Edition 2020 except as superseded by ADOT Bridge Design Guidelines.

Construction Specifications

Pima Association of Governments (PAG) Standard Specifications for Public Improvements 2015 Edition and the Special Provisions.

Design Loadings

Dead Load - Dead Load Includes allowance of 25 pounds per square foot (psf) for future wearing surface.

Live Load - AASHTO HL-93.

Hydraulic Design Criteria

Drainage Information provided by HDR Engineering, Inc. for Pima County Department of Transportation Project No. 4MADBR (HDR Project No. 10416569), November 2025.

Q₁₀₀ is based on the 100-yr precipitation levels increased by 15% in accordance with Pima County Flood Control Technical Policy, TECH-010.

Q₁₀₀ = 1608 cfs, V₁₀₀ = 10.4 fps, H.W. Elevation = 3659.9
Q₅₀₀ = 1424 cfs, V₅₀₀ = 9.7 fps, H.W. Elevation = 3659.6

Concrete and Reinforcement Strengths

Superstructure except Barriers (Class X) f'c = 4500 psi
Abutments, Pier Walls, Bottom Slab, Wingwalls, Concrete Apron, and Cutoff Walls (Class S) f'c = 3500 psi
Approach Slabs and Barriers (Class S) f'c = 4000 psi
Grade 60 Reinforcing Steel fy = 60,000 psi
Grade 60 Longitudinal Deck Reinforcing Steel fs = 28,000 psi

Reinforcing steel shall conform to ASTM A615. All reinforcing shall be furnished as Grade 60.

All Mechanical splices of reinforcing steel shall develop 125% of the yield strength of the reinforcing bar and shall conform to the requirements for mechanical connections in Section 605-3.02 of the Standard Specifications.

All bends/hooks shall meet the requirements of AASHTO LRFD, Article 5.10.2.
All bend dimensions for reinforcing steel shall be out-to-out of bars.
All placement dimensions for reinforcing steel shall be to center of bars, unless noted otherwise.

All reinforcing shall have 2 inch clear cover, unless noted otherwise.

Concrete Barriers & Parapets

Concrete barriers shall be constructed after concrete deck falsework has been removed.

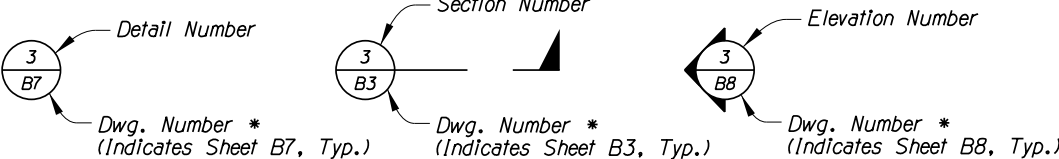
Concrete barriers shall not be slip formed.

Dimensions

Dimensions shall not be scaled from drawings. All dimensions are in feet and inches and all stations and elevations are in feet.

Vertical dimensions are measured plumb, unless noted otherwise.

Legend



* "-" Indicates Section or Detail is located on same drawing.

Construction Joints

All roughened construction joints to be roughened to 1/4" minimum amplitude.

Coordination

Contractor shall coordinate all existing conditions during construction of project. Utility information shown on the plans may not be complete or accurately depict the location of the facilities shown. The contractor shall coordinate the location of all existing, new, relocated, and abandoned utilities with the project plans and notify respective owners before commencing the work of excavation. Conflicts shall be brought to the attention of the Engineer and resolved prior to proceeding with the work.

Chamfer

All exposed corners shall be chamfered 3/4" unless noted otherwise. See Chamfer Detail this Sheet.

Standard Drawing List

ADOT Bridge Group SD Drawings - SD 1.11 and SD 2.01.
PAG Standard Detail Drawings - Std. Dtl. 105.

Inventory and Operating Rating

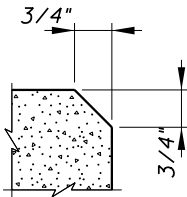
Inventory and operating ratings for HL-93 are in accordance with AASHTO Manual for Bridge Evaluation, 3rd Edition 2018 with Interim Revisions through 2019 and with the Load and Resistance Factor Rating Method.
Inventory Load Rating Factor: 1.xx
Operating Load Rating Factor: 2.xx

Existing Bridge Removal

The existing Madera Canyon Road Bridge at Medium Wash (Structure No. 8301) is a three-span cast-in-place slab bridge constructed in 1935. The Contractor shall remove the existing bridge. See Special Provisions.

Seismic

The bridge site is Site Class D with peak ground acceleration (PGA) = 0.069g and horizontal response spectral acceleration coefficient at 0.2 sec return period (S_s) of 0.158g, and horizontal response spectral acceleration coefficient at 1.0 sec return period (S₁) of 0.046g. The bridge site is classified as Seismic Zone 1.



Chamfer all exposed corners thus unless otherwise noted.
This note applicable to all sheets pertaining to the structure.

CHAMFER DETAIL
No Scale

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0121410			
T0541.DIC					

Kathryn Skinner, P.E., Director

Date	Designed	Drawn	Checked	Proj. Engr.
06/2025	GWS	TRK	DL	TWB
06/2025				
06/2025				

No.	Revision Description	Engineer	Date

INITIAL
PS&E
SUBMITTAL
Not For
Construction
or Recording

HDR

MADERA CANYON ROAD
MEDIUM WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADBR

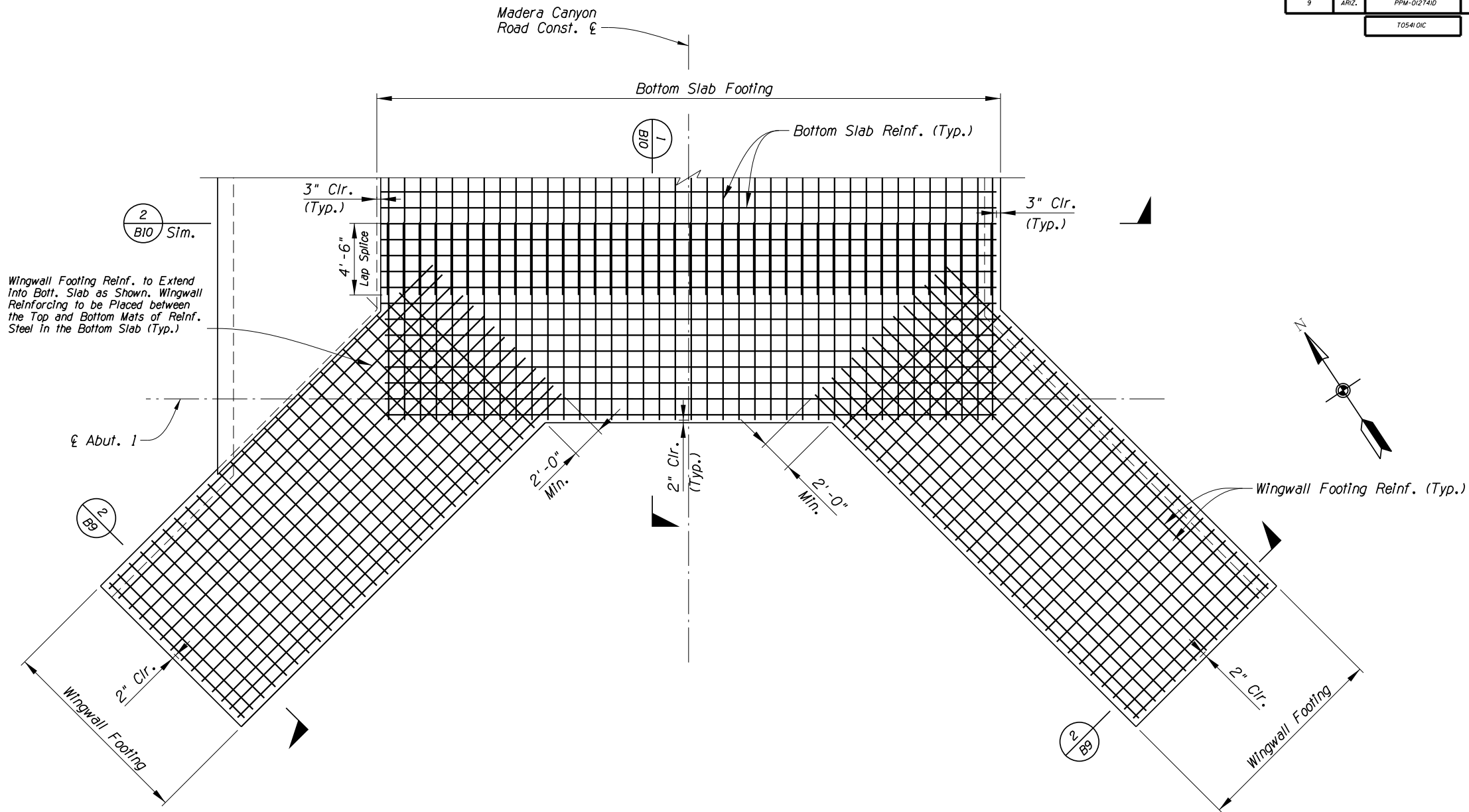
Madera Canyon Road, Medium Wash Bridge Replacement (4MADBR)

Pima County Department of Transportation



GENERAL NOTES

Project ID: 10416569
Client Number: 4108
Penetible: C:\PMA\PLOT\ORDR.TBL
Plot Driver: 10416569_VPlot_B&W_PDF.plt



ABUTMENT AND WINGWALL FOOTING REINFORCEMENT PLAN

(Abut. 1 shown, Abut. 2 similar)
Scale: 1/4" = 1'-0"

Notes:

- For additional information not shown, see sheets B9 and B10.
- Vertical dowels at abutment walls and wingwalls not shown. Cutoff wall reinforcing, additional footing reinforcing near piers, and concrete apron reinforcing not shown.
- Bottom Slab transverse bars shall be placed parallel to abutment and pier centerlines. Spacing of transverse bars is measured along Const. CL.
- Bottom Slab longitudinal bars shall be placed parallel to Const. CL. Spacing of longitudinal bars is measured perpendicular to Const. CL.



ABUTMENT FOOTING DETAILS

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-012141D			
T0541.DIC					

Kathryn Skinner, P.E., Director

Date	Designed	Drawn	Checked	Proj. Engr.
06/2025	GWS	TRK	DL	TWB
06/2025				
06/2025				

No.	Revision Description	Engineer	Date

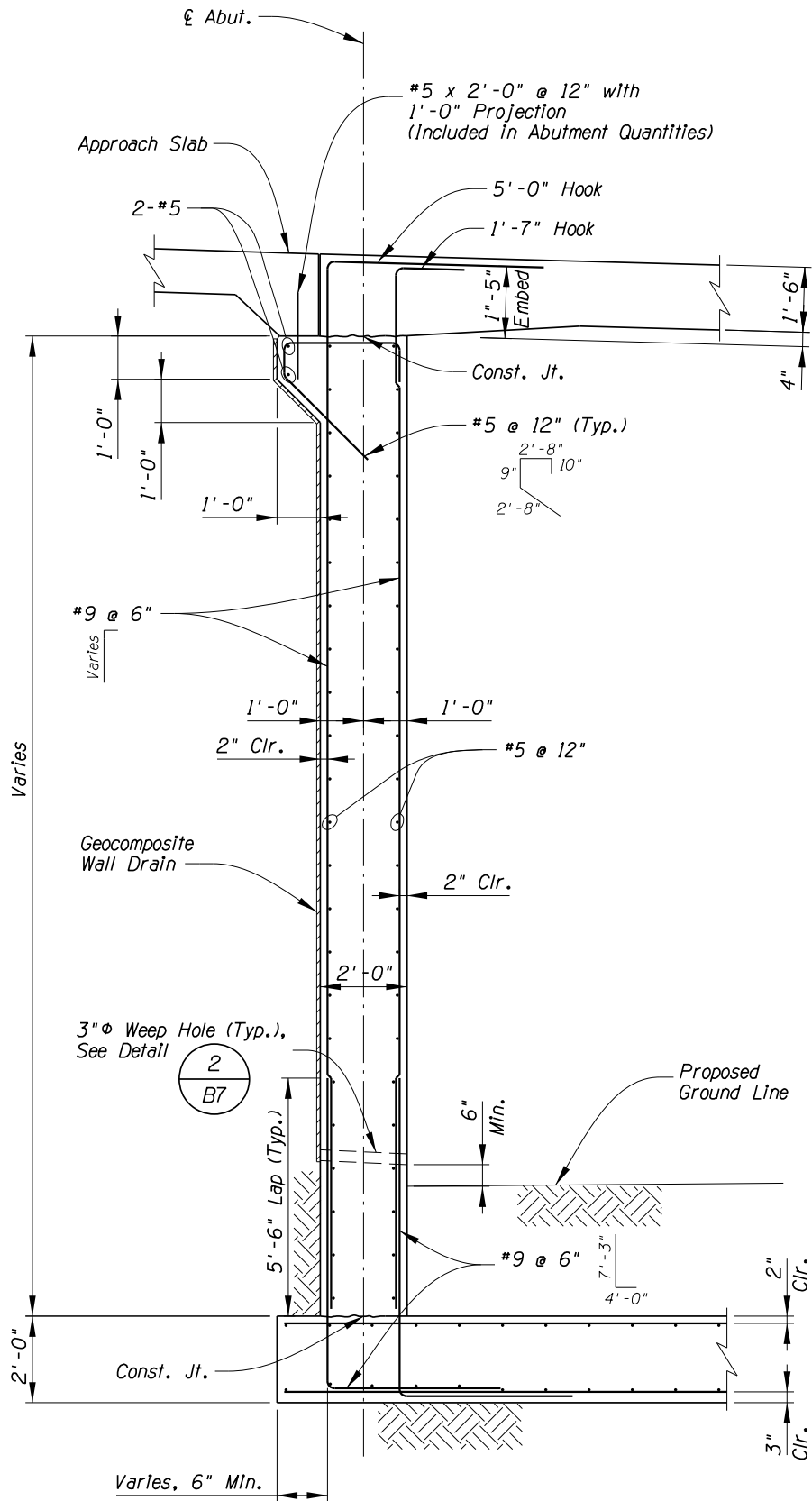
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Not For
Construction
or Recording

PC

MADERA CANYON ROAD
MEDIUM WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADBR

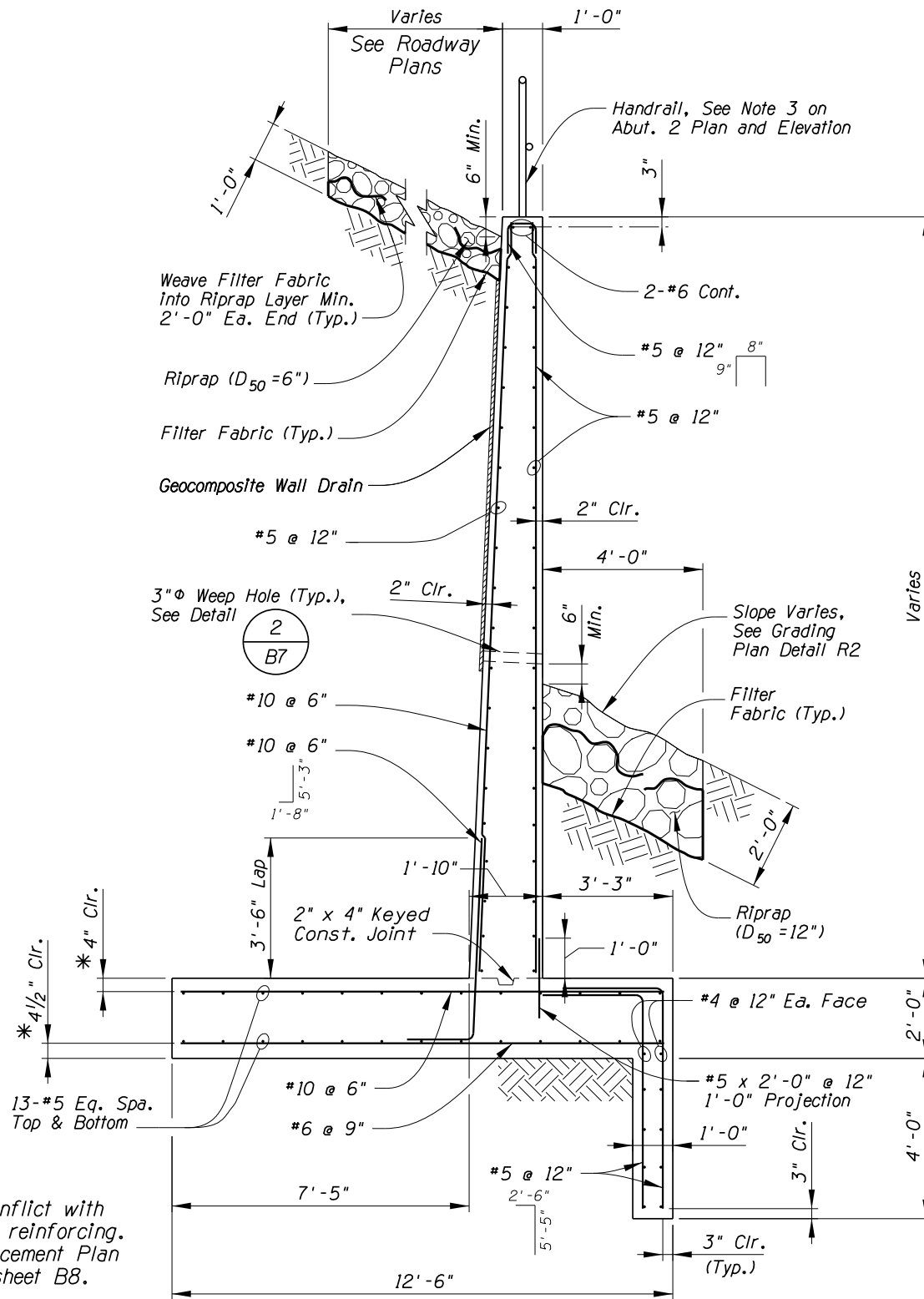
Pima County Department of Transportation

Madera Canyon Road, Medium Wash Bridge Replacement (4MADBR)



TYPICAL ABUTMENT SECTION
Scale: 1/2" = 1'-0"

1



TYPICAL WINGWALL SECTION
Scale: 1/2" = 1'-0"

2

* To avoid conflict with bottom slab reinforcing. See Reinforcement Plan details on sheet B8.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	PPM-0121410			
T0541.DIC					



ABUTMENT & WINGWALL DETAILS

Kathryn Skinner, P.E., Director

Date	GWS	TRK	DL	TWB
06/2025				
06/2025				
06/2025				
06/2025				

No.	Revision	Description	Engineer	Date

INITIAL
PS&E
SUBMITTAL
Not For
Construction
or Recording

PC

MADERA CANYON ROAD
MEDIUM WASH
BRIDGE REPLACEMENT
PROJECT NO. 4MADBR

Pima County Department of Transportation

Madera Canyon Road, Medium Wash Bridge Replacement (4MADBR)

APPENDIX B

Geotechnical Data Report (Terracon Consultants)

Madera Canyon Road, Florida Canyon Wash and Medium Wash Bridges

Florida Canyon Wash

ADOT Project No.: T0540

Federal Project No.: PPM-0(273)D

Pima County Project No.: 4MADFL

Medium Wash

ADOT Project No.: T0541

Federal Project No.: PPM-0(274)D

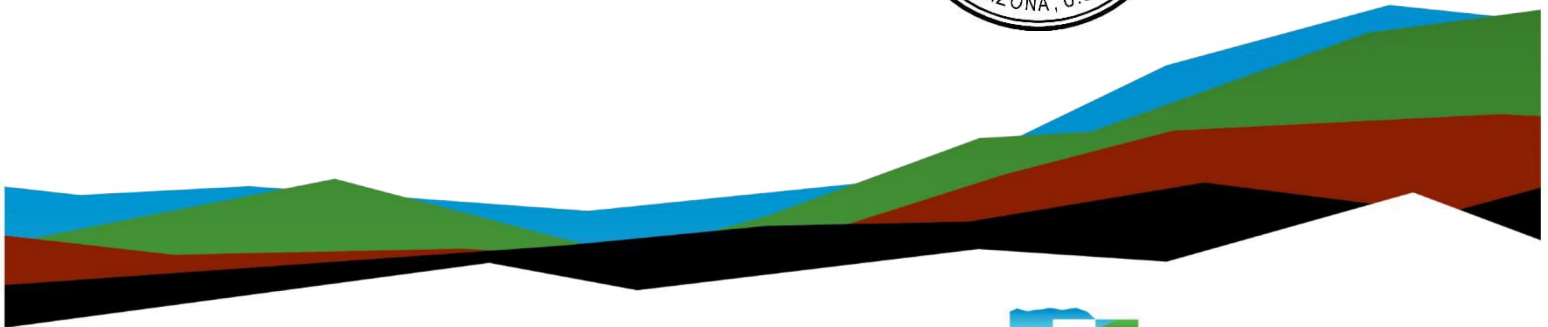
Pima County Project No.: 4MADBR

Geotechnical Data Report

November 18, 2025 | Terracon Project No. 63245064

Prepared for:

HDR Engineering, Inc.
One South Church Ave., Suite 1400
Tucson, Arizona 85701



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- Facilities
- Environmental
- Geotechnical
- Materials



355 S. Euclid Ave, Ste. 107
Tucson, Arizona 85719
P (520) 770-1789
Terracon.com

November 18, 2025

HDR Engineering, Inc.
One South Church Ave., Suite 1400
Tucson, Arizona 85701

Attn: Mr. Ted Buell, P.E.
P: (520) 584-3632
E: Ted.Buell@hdrinc.com

Re: **Geotechnical Data Report**
Madera Canyon Road, Florida Canyon Wash and Medium Wash Bridges
Pima County, Arizona
Terracon Project No. 63245064

Dear Mr. Buell:

We have completed the scope of Geotechnical Data services for the above referenced project in general accordance with Terracon Proposal No. P63245064, Revision No. 3 dated August 26, 2024. This geotechnical data report presents the findings of the subsurface exploration and laboratory testing for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon



Louis D. Braun, P.E.
Geotechnical Department Manager

A blue ink signature of Donald R. Clark.

Donald R. Clark, P.E.
Sr. Consultant/Sr. Principal

Table of Contents

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Project Description.....

Site Conditions.....

Geotechnical Characterization

Subsurface Conditions

Laboratory Test Data.....

Groundwater Conditions.....

Corrosivity

General Comments

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Attachments

- Exploration and Testing Procedures
- Photography Log
- Site Location and Exploration Plans
- Exploration Results
- Supporting Information

Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the  logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com. Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Data services performed for the Madera Canyon Road Bridge project located on South Madera Canyon Road in Pima County, Arizona. The purpose of these services was to provide information and geotechnical engineering data relative to:

- Subsurface soil conditions
- Groundwater conditions
- Existing pavement thicknesses
- Laboratory test results
- Corrosion test results

The geotechnical engineering Scope of Services for this project included the advancement of 12 test borings to approximate depths of 5 to 76 feet below the existing ground surface, laboratory testing, and preparation of this report.

Maps showing the site and boring locations are shown on the [Site Location](#) and [Exploration Plan](#), respectively. A log of each boring is included in the [Exploration Results](#) section of this report. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are summarized in part on the boring logs and are provided in graphical and tabular form in the [Exploration Results](#) section of this report.

Project Description

Our initial understanding of the project was provided in our proposal and our final understanding of the project conditions is as follows:

Item	Description
Project Description	The proposed construction will include reconstructing portions of South Madera Canyon Road as well as adding to the roadway as it approaches Florida Canyon Wash and Medium Wash. The pavement will consist of an asphalt concrete section. The new bridges at Florida Canyon Wash and Medium Wash are proposed as single-span precast girder bridges supported on drilled shaft foundations or multi-span superbox bridges supported on a continuous concrete base slab.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Location Information	The project is located along South Madera Canyon Road in Pima County, Arizona. Medium Wash Latitude/Longitude (approx.): 31.78789, -110.88448 Florida Canyon Wash Latitude/Longitude (approx.): 31.78214, -110.88694 See Site Location for additional site information.
Existing Improvements	An existing one-lane, two span bridge crosses Florida Canyon Wash and an existing one-lane, three span bridge crosses Medium Wash. The current roadway is paved with asphalt concrete.

Geotechnical Characterization

Subsurface Conditions

Specific conditions encountered at the boring locations are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs included in the [Exploration Results](#). Based on the results of the borings, subsurface soil conditions on the project site can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (ft)	Material Encountered	Relative Density/ Consistency
Pavement	2½ to 3½ inches	Asphalt ¹	---
1	76 (Maximum Depth Explored)	Sand and Gravel soils with variable amounts of Clay and Silt ²	Primarily Medium Dense to Very Dense

1. Encountered at boring locations P1 through P8
2. Sandy lean clay soils with hard consistency were encountered at boring location MB2 at approximated depths of 17 to 29 feet below the existing ground surface.

Laboratory Test Data

Laboratory tests were conducted on selected soil samples and the test results are presented in the [Exploration Results](#). The laboratory testing and a summary of the test results are presented in the following table:

Laboratory Test	Summary of Test Results
Atterberg Limits (ASTM D4318)	The Atterberg limit test results of the on-site soils indicate the existing materials exhibit non-plastic to medium plasticity characteristics. The test results indicated Plasticity Indices ranged from non-plastic to 16.
Grain Size/Gradation (ASTM D6913)	The gradation test results of the on-site soils indicate percent sand ranged from approximately 28 to 78 percent, and percent gravel ranged from about 0 to 58 percent. The gradation and percent passing No. 200 sieve test results of these soils indicate percent fines ranging from approximately 4 to 63 percent. The on-site soils are classified as SM, SC, SC-SM, SW-SM, GP-GM, GW-GM, GC-GM, GC, GW, GP-GC, CL, and CL-ML according to the Unified Soil Classification System.
Dry Density (ASTM D2937)	Testing of selected soil samples obtained from the borings indicated in-situ dry densities ranging from approximately 98 to 131 pounds per cubic foot (pcf).
Moisture Content (ASTM D2216)	Testing of selected soil samples obtained from the borings indicated in-situ moisture contents ranging from approximately 1 to 13 percent.

Laboratory Test	Summary of Test Results
Standard Proctor (ASTM D698)	Standard Proctor testing of various samples obtained from the site indicated maximum dry densities ranging from approximately 115 to 130 pounds per cubic foot (pcf); and optimum moisture contents ranging from approximately 9.1 to 13.3 percent. The same samples indicated rock-corrected maximum dry densities ranging from approximately 128 to 137 pounds per cubic foot (pcf); and optimum water contents ranging from approximately 6.5 to 9.3 percent.
Remolded Swell (ASTM D4546)	When water was added to samples of laboratory compacted on-site near surface sand soils, the compacted soils exhibited low to high expansive potential when subjected to light loading conditions and in response to wetting.
Consolidation/ Compression (ASTM D4546)	In response to wetting of relatively undisturbed samples while supporting typical foundation pressures, some near surface soils exhibited low hydro-compaction (collapse) potential. The same soils indicated low to moderate compression at in-situ moisture content and density under typical foundation pressures.
Direct Shear (ASTM D3080)	Three direct shear tests were performed on subgrade samples at the Medium Wash location. Based on maximum shear stress, the tests yielded friction angles of 25 degrees to 45 degrees, with corresponding apparent cohesion values of 653 pounds per square foot (psf) to 1,274 psf. When interpreted using maximum displacement, the same soils exhibited friction angles of 27 degrees to 43 degrees, with apparent cohesion values of 106 psf to 1,121 psf.
R-Value (ASTM D2844)	Two R-Value tests were performed on subgrade samples below the existing pavement. The test results indicate the tested soils have R-Value of 45 and 72.

Groundwater Conditions

Groundwater was not observed in any of the test borings at the time of our field exploration. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

Based on information obtained from the Arizona Department of Water Resources – Groundwater Data website (<https://gisweb.azwater.gov/waterresourcedata/GWSI.aspx>), the depth to groundwater in the vicinity of the project alignment is presented in the following table:

Geotechnical Data Report

Madera Canyon Road, Florida Canyon Wash and Medium Wash Bridges | Pima County, Arizona
November 18, 2025 | Terracon Project No. 63245064



Well Reg. I.D.	Approx. Depth to Groundwater (ft)	Approx. Water Elevation (ft MSL)	Date Last Checked	Comment
Local ID: D-19-14 14DCB	52	3,708	February 2005	Approximately 4,000 feet southeast of Boring FB1
Local ID: D-19-14 22AAC	87	3,803	January 1995	Approximately 5,000 feet south-southwest of Boring P1

Corrosivity

The table below lists the results of laboratory pH, soluble sulfate, soluble chloride, soluble sulfide, oxidation reduction potential, total salts, and laboratory minimum electrical resistivity testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction. The actual test data from each sample is provided in the [Exploration Results](#) section of this report.

Boring ID	Sample Depth (feet)	Soil Description	Soluble Sulfate (mg/kg)	Soluble Chloride (mg/kg)	Electrical Resistivity (Ω -cm)	pH	Sulfides (mg/kg)	Red-Ox (RmV)	Totals Salts (mg/kg)
FB1	1-2½	SC	61	14	2700	7.08	nil	277	410
FB1	6-7½	SC-SM	9	10	5500	7.59	nil	272	150
FB2	0-1½	SC	102	21	7600	7.03	nil	317	85
FB2	3-5	SM	25	21	14000	7.69	nil	294	70
MB1	0-2½	GW-GM	19	28	27000	7.86	nil	243	90
MB1	5-7½	GC	72	30	8000	6.29	nil	354	115
MB2	2½-5	SC-SM	15	14	24000	8.03	nil	246	85
MB2	5-7½	GM	17	18	15000	7.83	nil	260	120

A qualified corrosion engineer should be consulted to review the results of soil chemistry tests and relation to project infrastructure in contact with soils or backfill to assess the need for corrosion protection and to design appropriate protective measures.

General Comments

This report presents data obtained from the borings performed at the specified locations and from other information discussed in this report. Variations in the soil conditions may occur between borings, across the site, or due to the modifying effects of weather.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made.

We have appreciated being of service to you in the geotechnical engineering phase of this project and are prepared to assist you during the construction phases as well. If you have any questions concerning this report or any of our testing, inspection, design, and consulting services, please do not hesitate to contact us.

Geotechnical Data Report

Madera Canyon Road, Florida Canyon Wash and Medium Wash Bridges | Pima County, Arizona
November 18, 2025 | Terracon Project No. 63245064



Attachments

Contents:

Exploration and Testing Procedures

Exploration and Testing Procedures

Field Exploration

A total of 12 test borings were drilled at the project site on September 8 to 15, 2025. The approximate boring locations at the project site are shown on the [Exploration Plan](#), and the location and depth of the borings are summarized in the following table:

Boring Number	Latitude	Longitude	Boring Depth (feet)	Location
FB1	31.78198	-110.88691	60½	Florida Canyon Wash South Abutment
FB2	31.78211	-110.88686	60½	Florida Canyon Wash North Abutment
MB1	31.78781	-110.88446	60½	Medium Wash South Abutment
MB2	31.78802	-110.88425	76	Medium Wash North Abutment
P1	31.77982	-110.88764	6	Madera Canyon Roadway South of Florida Canyon Wash Bridge
P2	31.78090	-110.88743	6½	
P3	31.78334	-110.88650	5½	
P4	31.78439	-110.88609	6½	Madera Canyon Roadway North of Florida Canyon Wash Bridge
P5	31.78568	-110.88567	6	Madera Canyon Roadway South of Medium Wash Bridge
P6	31.78684	-110.88533	5	
P7	31.78898	-110.88361	6	Madera Canyon Roadway North of Medium Wash Bridge
P8	31.78990	-110.88288	6½	

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±15 feet) and referencing existing site features. Approximate ground surface elevations were provided by HDR based on survey data.

Subsurface Exploration Procedures: The pavement borings were advanced with a truck-mounted-mounted, CME-75 drill rig utilizing 7-inch outside diameter hollow-stem augers. The bridge borings were advanced with a track-mounted, Terra sonic drill rig utilizing 4-inch casing. At selected intervals samples of the subsurface materials were taken at each boring location by driving split-spoon (SPT) or ring-lined barrel samplers in general accordance with ASTM Standards. In the split-barrel sampling procedure, a standard 2-inch

outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. split-barrel sampling spoon with a 2.5-inch I.D. ring lined sampler was also used for sampling in the soil borings. Ring-lined, split-barrel sampling procedures are similar to the standard split spoon sampling procedure; however, blow counts are typically recorded for 6-inch intervals for a total of 12 inches of penetration.

Bulk samples of subsurface materials were obtained from all the borings. Continuous bulk samples were obtained from the sonic drilling rig. Photographs of the sonic drilling rig set up and an example of the sample retrieval can be found in the [Photography Log](#) section of this report. Groundwater was not encountered during the field exploration. For safety purposes, the borings were backfilled with auger cuttings upon completion. In areas of existing pavement the borehole was sealed with a drill hole plug and patched with asphalt after their completion.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) as shown in the [Exploration Results](#) section of this report. At that time, the field descriptions were confirmed or modified as necessary, and an applicable laboratory testing program was developed by HDR upon review of the field boring logs to determine the engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples, as requested by HDR, and the test results are presented in the [Exploration Results](#) section of this report. Laboratory tests were performed in general accordance with the applicable ASTM, local, or other accepted standards.

Geotechnical Data Report

Madera Canyon Road, Florida Canyon Wash and Medium Wash Bridges | Pima County, Arizona
November 18, 2025 | Terracon Project No. 63245064



Selected soil samples obtained from the site were tested for the following engineering properties:

- Atterberg Limits (ASTM D4318)
- Grain Size Analysis (ASTM D6913)
- Dry Unit Weight (ASTM D2937)
- Moisture Content (ASTM D2216)
- One-Dimensional Collapse (ASTM D4546)
- Soluble Sulfates (ASTM C1580)
- Chloride (ASTM D512)
- Soil Resistivity (ASTM G57)
- pH (ASTM G51)
- Sulfides (AWWA 4500-S D)
- Red-Ox (ASTM G200)
- Total Salts (AWWA 2520 B)
- Direct Shear (ASTM D3080)
- Standard Proctor (ASTM D698)
- R-Value (ASTM D2844)

Geotechnical Data Report

Madera Canyon Road, Florida Canyon Wash and Medium Wash Bridges | Pima County, Arizona
November 18, 2025 | Terracon Project No. 63245064



Photography Log



Setting up Sonic Rig on MB2



View of Sonic Rig on MB1



View of Sonic Rig on FB1



Continuous Sample for FB1 at 5 to 7.5 feet

Site Location and Exploration Plans

Contents:

Site Location
Exploration Plan

Note: All attachments are one page unless noted above.

Geotechnical Data Report

Madera Canyon Road, Florida Canyon Wash and Medium Wash Bridges | Pima County, Arizona
November 18, 2025 | Terracon Project No. 63245064



Site Location

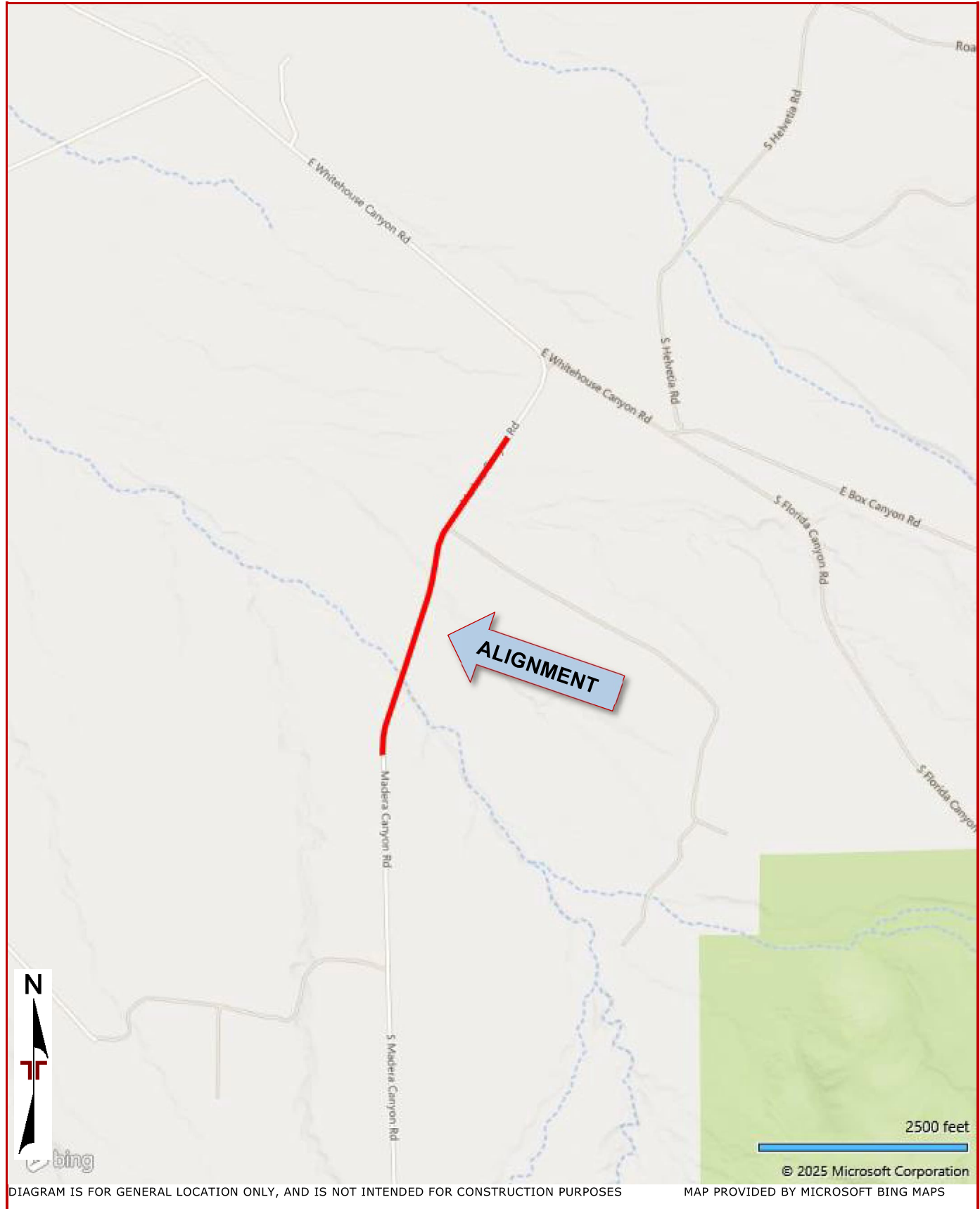


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

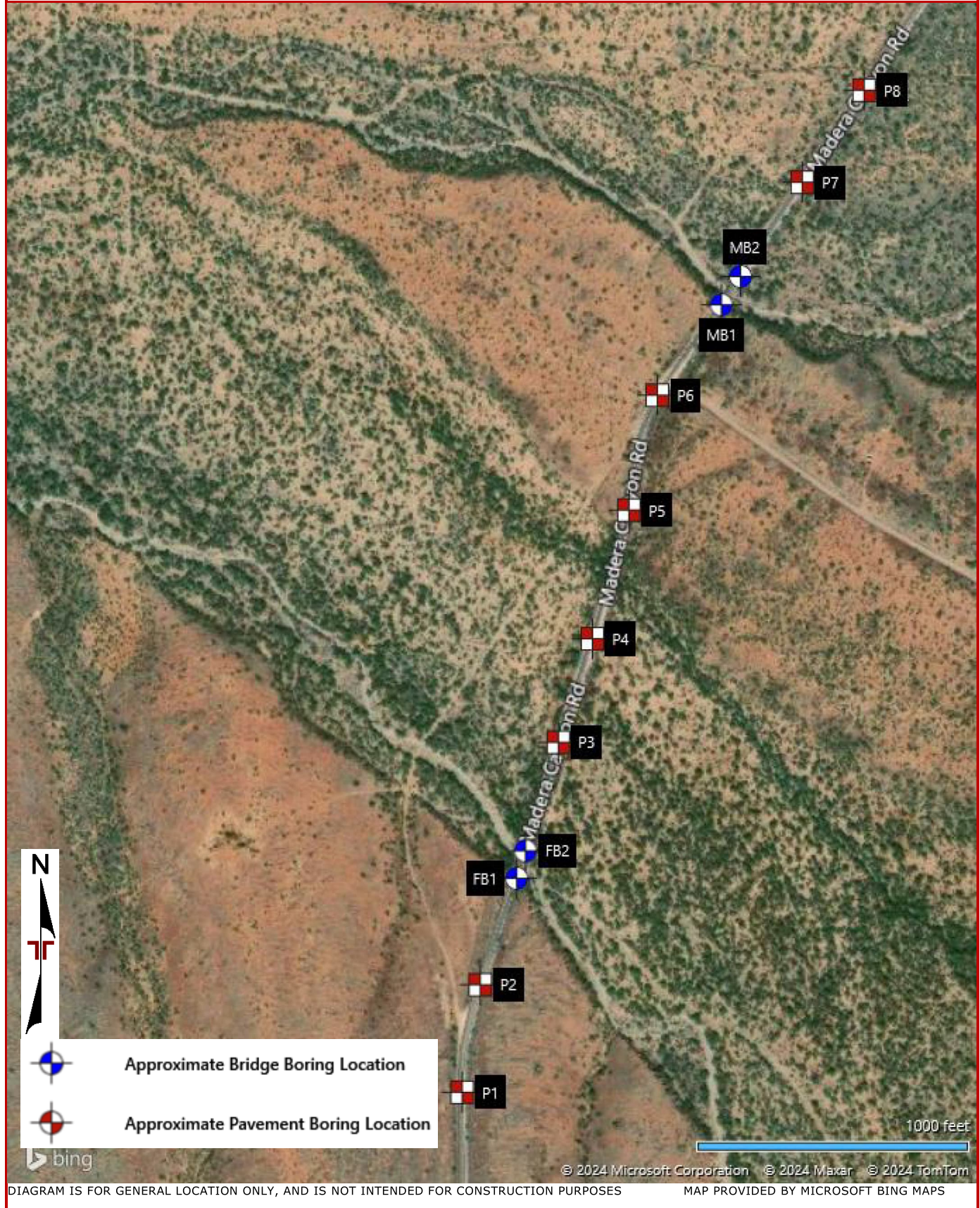
MAP PROVIDED BY MICROSOFT BING MAPS

Geotechnical Data Report

Madera Canyon Road, Florida Canyon Wash and Medium Wash Bridges | Pima County, Arizona
November 18, 2025 | Terracon Project No. 63245064



Exploration Plan



Exploration Results

Contents:

Boring Logs (17 pages)
Atterberg Limits (2 pages)
Grain Size Distribution (9 pages)
Moisture Density Relationship (7 pages)
One-Dimensional Collapse (2 pages)
R-Value (2 pages)
Direct Shear (6 pages)
Corrosion (2 pages)
Summary of Laboratory Results (3 pages)

Note: All attachments are one page unless noted above.

Graphic Log	Location: See Exploration Plan Latitude: 31.78198° Longitude: -110.88691°		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	
	Depth (Ft.)	Approximate Elevation: 3673 (Ft.)							LL-PL-PI	Percent Fines
					↓					
	CLAYEY SAND WITH GRAVEL (SC), fine to coarse grained, subangular to angular, medium plasticity, brown, very dense									
	4.0	3669				9-23-28 N=51	5.2		28-17-11	22.9
									29-18-11	30.4
	SILTY CLAYEY SAND (SC-SM), fine to medium grained, angular, low plasticity, brown, very dense lens of well graded gravel with sand		5			50/6"				3.6
									26-21-5	36.9
	8.5	3664.5				11-50/4"				
	CLAYEY SAND (SC), fine to medium grained, low plasticity, brown, very dense								24-16-8	36.3
			10			50/5"				
			15			7-20-50/1"				
	15.0	3658				50/1"			26-23-3	22.4
	SILTY SAND (SM), fine to medium grained, low plasticity, brown, very dense									
			20			50/5"				
			25			14-23			22-19-3	32.3
	23.0	3650				50/5"	3.7			
	CLAYEY SAND (SC), fine to medium grained, low plasticity, brown, very dense									
	very dense		30			12-50/1"	4.3			
	trace cobbles, gray									

Boring Completed
09-11-2025

Boring Log No. FB1

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Percent Fines
	Latitude: 31.78198° Longitude: -110.88691°								LL-PL-PI		
	Depth (Ft.)		Approximate Elevation: 3673 (Ft.)								
	CLAYEY SAND (SC) , fine to medium grained, low plasticity, brown, very dense <i>(continued)</i>										
	tan to brown		35			50/5"					
	gray to brown		40			50/0"					
			45			13-24-50/4"	8.5				
			50			25-22-50/2"					
dense		55			16-14-17 N=31	8.4					
60.5 very dense, lens of silty sand		3612.5	60			50/5"					
Boring Terminated at 60.5 Feet											

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
Terra Sonic

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
4 Inch Casing

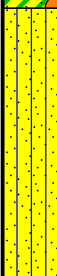
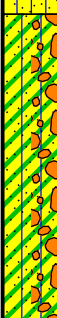
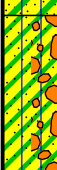
Logged by
B. Thomas

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Boring Started
09-11-2025

Boring Completed
09-11-2025

Boring Log No. FB2

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78211° Longitude: -110.88686°								LL-PL-PI	
	Depth (Ft.) Approximate Elevation: 3666 (Ft.)									
	CLAYEY SAND WITH GRAVEL (SC) , trace gravel, fine grained, angular, low plasticity, brown lens of lean clay with sand		2.0						27-19-8	26.4
	SILTY SAND (SM) , fine to coarse grained, angular, nonplastic, dark brown, dense		3664							
	light brown, lens of clayey sand		5			17-50/3"	3.8		NP	27.7
						9-21-26 N=47				
						18-50/3"				
			9.0							
	SILTY CLAYEY SAND WITH GRAVEL (SC-SM) , fine to medium grained, angular, low plasticity, light brown to brown, very dense		3657						23-17-6	31.6
	dense		10			50/3"				
						14-50/1"				
	very dense		15			50/4"				
			17.0							
	SILTY CLAYEY SAND (SC-SM) , fine to medium grained, low plasticity, light brown, very dense		3649			25-50/2"				
			20			50/0"			26-20-6	30.1
			25			50/3"				
	SILTY CLAYEY SAND WITH GRAVEL (SC-SM) , fine to medium grained, angular, low plasticity, light brown, very dense		3637							
			29.0			17-50/1"	6.1			
									25-18-7	23.1

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
Terra Sonic

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
4 Inch Casing

Logged by
B. Thomas

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Boring Started
09-10-2025

Boring Completed
09-11-2025

Boring Log No. FB2

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78211° Longitude: -110.88686°								LL-PL-PI	
	Depth (Ft.)	Approximate Elevation: 3666 (Ft.)								
	34.0	3632								
	CLAYEY SAND (SC) , fine to coarse grained, low plasticity, light brown to brown, very dense		35			50/0"				
			40			50/3"				
			45			25-50/6"				
	dense		50			15-21-21 N=42	8.4			
	medium dense		55			9-14-13 N=27	10.1			
	58.0	3608								
	SILTY SAND (SM) , trace clay, fine to coarse grained, nonplastic, tan, very dense									
	60.5	3605.5	60			50/2"				
	Boring Terminated at 60.5 Feet									

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
Terra Sonic

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
4 Inch Casing

Logged by
B. Thomas

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Boring Started
09-10-2025

Boring Completed
09-11-2025

Boring Log No. MB1

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78781° Longitude: -110.88446°								LL-PL-PI	
	Depth (Ft.)	Approximate Elevation: 3656 (Ft.)								
		WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM) , fine to coarse grained, angular, nonplastic, dark brown							NP	8.2
	2.5	3653.5				5-50/1"			24-18-6	20.9
	5.0	3651								
		CLAYEY GRAVEL WITH SAND (GC) , fine to coarse grained, angular, low plasticity, dark brown, medium dense, lens of silty sand with gravel				8-31	1.0	128	NP	13.2
	7.5	3648.5							25-16-9	27.6
		SILTY CLAYEY SAND WITH GRAVEL (SC-SM) , fine to coarse grained, angular, low plasticity, dark brown, medium dense				3-5-15 N=20	13.2		25-20-5	36.5
	10.0	3646								
		CLAYEY SAND (SC) , fine to coarse grained, medium plasticity, dark brown, dense, lens of silty sand				18-33	8.3	131	NP	11.2
		medium dense							28-16-12	49.1
		very dense, lens of poorly graded gravel with sand				3-7-9 N=16	12.4			
	15.0					50/6"				5.3
						20-50/2"				
	19.0	3637								
		SILTY CLAYEY SAND WITH GRAVEL (SC-SM) , fine to coarse grained, angular, low plasticity, brown, dense lens of sandy silty clay				21-50/3"				63.3
									25-19-6	38.3
		very dense								
	25.0					21-50/2"				
	29.0	3627								
		SILTY CLAYEY SAND (SC-SM) , fine to coarse grained, low plasticity, brown, very dense				23-50/2"	7.2			
									23-17-6	48.0

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
Terra Sonic

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
4 Inch Casing

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
A. Smith/ B. Thomas

Boring Started
09-09-2025

Boring Completed
09-09-2025

Boring Log No. MB1

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78781° Longitude: -110.88446°								LL-PL-PI	
	Depth (Ft.)		Approximate Elevation: 3656 (Ft.)							
	SILTY CLAYEY SAND (SC-SM) , fine to coarse grained, low plasticity, brown, very dense <i>(continued)</i>		35			50/5"				
	39.0		3617							
	CLAYEY SAND (SC) , fine to coarse grained, angular, medium plasticity, brown, very dense, gravels and cobbles throughout layer		40			50/4"	3.4			
	lens of silty sand									
			45			13-50/4"	12.6			
			50			22-50/3"				
			55			16-30-35 N=65	12.4			
	lens of lean clay									
	60.5		3595.5			50/5"	8.1			
	Boring Terminated at 60.5 Feet									

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
Terra Sonic

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
4 Inch Casing

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
A. Smith/ B. Thomas

Boring Started
09-09-2025

Boring Completed
09-09-2025

Boring Log No. MB2

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78802° Longitude: -110.88425°								LL-PL-PI	
	Depth (Ft.)	Approximate Elevation: 3662 (Ft.)								
	WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM) , fine to coarse grained, angular, low plasticity, brown								NP	9.0
	2.5	3659.5				7-15			NP	7.2
	SILTY CLAYEY SAND WITH GRAVEL (SC-SM) , fine to coarse grained, angular, low plasticity, brown, medium dense, lens of non-plastic poorly graded gravel with silt and sand								24-18-6	12.4
	5.0	3657								
	SILTY GRAVEL WITH SAND (GM) , fine to coarse grained, angular, nonplastic, brown, loose		5			3-4-4 N=8	1.6		NP	16.9
	7.5	3654.5								
	SILTY CLAYEY SAND WITH GRAVEL (SC-SM) , fine to coarse grained, angular, low plasticity, brown, medium dense, lens of poorly graded gravel with silt and sand					8-25			NP	7.4
									20-16-4	25.3
			10			2-15-14 N=29	2.2			
	dense					12-50/4"			24-20-4	33.6
	very dense		15			19-21-50/1"			24-19-5	29.6
	SANDY LEAN CLAY (CL) , fine to medium grained, low plasticity, light brown, hard, lens of low plasticity clayey sand					39-50/3"			31-22-9	40.8
	17.0	3645							26-17-9	53.0
			20			13-15-20 N=35	8.9		25-17-8	51.8
			25			2-50/5"				
			30			22-28-37 N=65	6.4			
	SILTY CLAYEY SAND (SC-SM) , fine to coarse grained, low plasticity, light brown, very dense								22-17-5	44.3
	29.0	3633								

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
Terra Sonic

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
4 Inch Casing

Logged by
A. Smith/ B. Thomas

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Boring Started
09-08-2025

Boring Completed
09-09-2025

Boring Log No. MB2

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78802° Longitude: -110.88425°								LL-PL-PI	
	Depth (Ft.)	Approximate Elevation: 3662 (Ft.)								
	SILTY CLAYEY SAND (SC-SM) , fine to coarse grained, low plasticity, light brown, very dense <i>(continued)</i>									
	35.0	3627	35			25-50/5"				
	CLAYEY GRAVEL WITH SAND (GC) , trace cobbles, fine to coarse grained, angular, low plasticity, brown, very dense									
	40.0	3622	40			17-26-24 N=50	7.7			
	CLAYEY SAND WITH GRAVEL (SC) , trace cobbles, fine to coarse grained, angular, medium plasticity, light brown, dense									
	low plasticity, very dense		45			21-50/5"	7.8			
	lens of silty clayey sand									
	medium plasticity		50			50/5"				
			55			50/3"				
			60			18-37-50/1"	11.9			
	lens of clayey gravel with sand		65			50/5"				

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
Terra Sonic

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
4 Inch Casing

Logged by
A. Smith/ B. Thomas

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Boring Started
09-08-2025

Boring Completed
09-09-2025

Boring Log No. MB2

Graphic Log	Location: See Exploration Plan Latitude: 31.78802° Longitude: -110.88425° Depth (Ft.) Approximate Elevation: 3662 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
								LL-PL-PI	
	CLAYEY SAND WITH GRAVEL (SC) , trace cobbles, fine to coarse grained, angular, medium plasticity, light brown, dense <i>(continued)</i> trace cobbles	70			20-50/3"	12.4			
		75			10-50/5"	10.5			
		76.0							
	Boring Terminated at 76 Feet	3586							
See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any). See Supporting Information for explanation of symbols and abbreviations. Elevation Reference: Elevations provided by HDR Engineering, Inc.			Water Level Observations Groundwater not encountered			Drill Rig Terra Sonic Hammer Type Automatic Driller GSI			
Notes			Advancement Method 4 Inch Casing Abandonment Method Boring backfilled with auger cuttings upon completion.			Logged by A. Smith/ B. Thomas Boring Started 09-08-2025 Boring Completed 09-09-2025			

Boring Log No. P1

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.77982° Longitude: -110.88764°								LL-PL-PI	
	Depth (Ft.)		Approximate Elevation: 3718 (Ft.)							
	0.5		ASPHALT CONCRETE, approximate thickness = 3-1/2"							
	CLAYEY SAND WITH GRAVEL (SC), fine to coarse grained, angular, medium plasticity, reddish brown, very dense		3717.5							
	fine to medium grained, dense		3712							
	6.0		3712							
	Boring Terminated at 6 Feet									

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
7 Inch Hollow Stem Auger

Logged by
B. Thomas

Abandonment Method
Boring backfilled with Auger Cuttings
Surface capped with asphalt

Boring Started
09-15-2025

Boring Completed
09-15-2025

Boring Log No. P2

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78090° Longitude: -110.88743°								LL-PL-PI	
	Depth (Ft.)	Approximate Elevation: 3705 (Ft.)								
	0.5	ASPHALT CONCRETE , approximate thickness = 3"	3704.5							
		CLAYEY SAND WITH GRAVEL (SC) , fine to coarse grained, angular, medium plasticity, reddish brown, dense				22-38	6.2	114	30-14-16	39.0
	4.0		3701							
		SILTY SAND WITH GRAVEL (SM) , fine to coarse grained, angular, nonplastic, gray, very dense								
	6.5		3698.5			23-30-50/5"				
	Boring Terminated at 6.5 Feet									

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
7 Inch Hollow Stem Auger

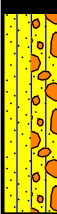
Logged by
B. Thomas

Abandonment Method
Boring backfilled with Auger Cuttings
Surface capped with asphalt

Boring Started
09-15-2025

Boring Completed
09-15-2025

Boring Log No. P3

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78334° Longitude: -110.88650°								LL-PL-PI	
	Depth (Ft.)		Approximate Elevation: 3666 (Ft.)							
	0.5		ASPHALT CONCRETE , approximate thickness = 2-1/2"		3665.5					
			SILTY SAND WITH GRAVEL (SM) , fine to medium grained, angular, nonplastic, brown, very dense						NP	23.4
	5.5		3660.5		50/2"					
Boring Terminated at 5.5 Feet										

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
7 Inch Hollow Stem Auger

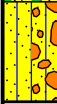
Logged by
B. Thomas

Abandonment Method
Boring backfilled with Auger Cuttings
Surface capped with asphalt

Boring Started
09-15-2025

Boring Completed
09-15-2025

Boring Log No. P4

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78439° Longitude: -110.88609°								LL-PL-PI	
	Depth (Ft.)	Approximate Elevation: 3660 (Ft.)								
	0.5	ASPHALT CONCRETE , approximate thickness = 2-1/2"	3659.5							
		SILTY CLAYEY SAND (SC-SM) , fine to medium grained, angular, low plasticity, brown, medium dense				10-11	2.9	98	18-14-4	37.1
	4.0		3656							
		SILTY SAND WITH GRAVEL (SM) , fine to coarse grained, angular, nonplastic, light brown, medium dense		5		18-18-10 N=28				
	6.5		3653.5							
Boring Terminated at 6.5 Feet										

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
7 Inch Hollow Stem Auger

Logged by
B. Thomas

Abandonment Method
Boring backfilled with Auger Cuttings
Surface capped with asphalt

Boring Started
09-15-2025

Boring Completed
09-15-2025

Boring Log No. P5

Graphic Log	Location: See Exploration Plan Latitude: 31.78568° Longitude: -110.88567°	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
								LL-PL-PI	
	Depth (Ft.)	Approximate Elevation: 3674 (Ft.)							
	0.5	ASPHALT CONCRETE , approximate thickness = 3-1/2"							
	3.1	CLAYEY SAND WITH GRAVEL (SC) , trace gravel, fine to medium grained, angular, medium plasticity, light brown, very dense							
					22-26-34 N=60			28-14-14	34.9
	6.0				32-50/4"	3.1	114		
	Boring Terminated at 6 Feet								

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
7 Inch Hollow Stem Auger

Logged by
B. Thomas

Abandonment Method
Boring backfilled with Auger Cuttings
Surface capped with asphalt

Boring Started
09-15-2025

Boring Completed
09-15-2025

Graphic Log	Location: See Exploration Plan	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78684° Longitude: -110.88533°							LL-PL-PI	
Depth (Ft.)	Approximate Elevation: 3674 (Ft.)								
	0.5 ASPHALT CONCRETE , approximate thickness = 3" 3673.5	5							
	SILTY CLAYEY SAND WITH GRAVEL (SC-SM) , trace clay, fine to coarse grained, angular, low plasticity, brown, very dense				34-50/5"	2.9	121	20-16-4	21.3
	auger grinding on layer of gravel/cobble								
	5.0 3669				50/2"				
Boring Terminated at 5 Feet									

Boring Completed
09-15-2025

Boring Log No. P7

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78898° Longitude: -110.88361°								LL-PL-PI	
	Depth (Ft.) Approximate Elevation: 3667 (Ft.)									
	0.5 ASPHALT CONCRETE , approximate thickness = 2-1/2" 3666.5		5			26-24-22 N=46			23-13-10	26.4
	4.0 3663									
	6.0 3661									
Boring Terminated at 6 Feet										

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
7 Inch Hollow Stem Auger

Logged by
B. Thomas

Abandonment Method
Boring backfilled with Auger Cuttings
Surface capped with asphalt

Boring Started
09-15-2025

Boring Completed
09-15-2025

Boring Log No. P8

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits	Percent Fines
	Latitude: 31.78990° Longitude: -110.88288°								LL-PL-PI	
	Depth (Ft.) Approximate Elevation: 3677 (Ft.)									
	0.5	ASPHALT CONCRETE , approximate thickness = 3-1/2"	3676.5							
		SILTY CLAYEY SAND WITH GRAVEL (SC-SM) , fine to coarse grained, angular, low plasticity, brown, medium dense				14-18	2.0	120	18-13-5	20.1
	4.0					3673				
		POORLY GRADED SAND (SP) , trace gravel, fine to coarse grained, angular, nonplastic, brown, medium dense								
	6.5		3670.5			4-6-6 N=12				
Boring Terminated at 6.5 Feet										

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevation Reference: Elevations provided by HDR Engineering, Inc.

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
GSI

Notes

Advancement Method
7 Inch Hollow Stem Auger

Logged by
B. Thomas

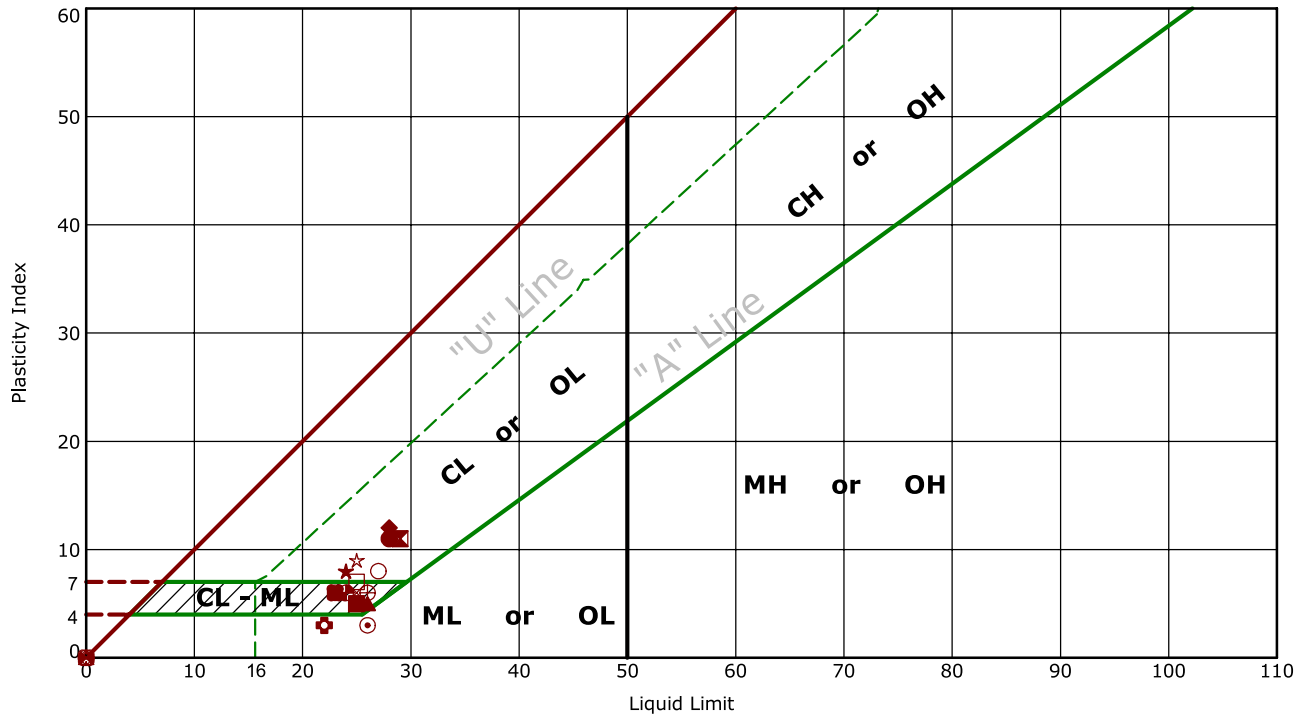
Abandonment Method
Boring backfilled with Auger Cuttings
Surface capped with asphalt

Boring Started
09-15-2025

Boring Completed
09-15-2025

Atterberg Limit Results

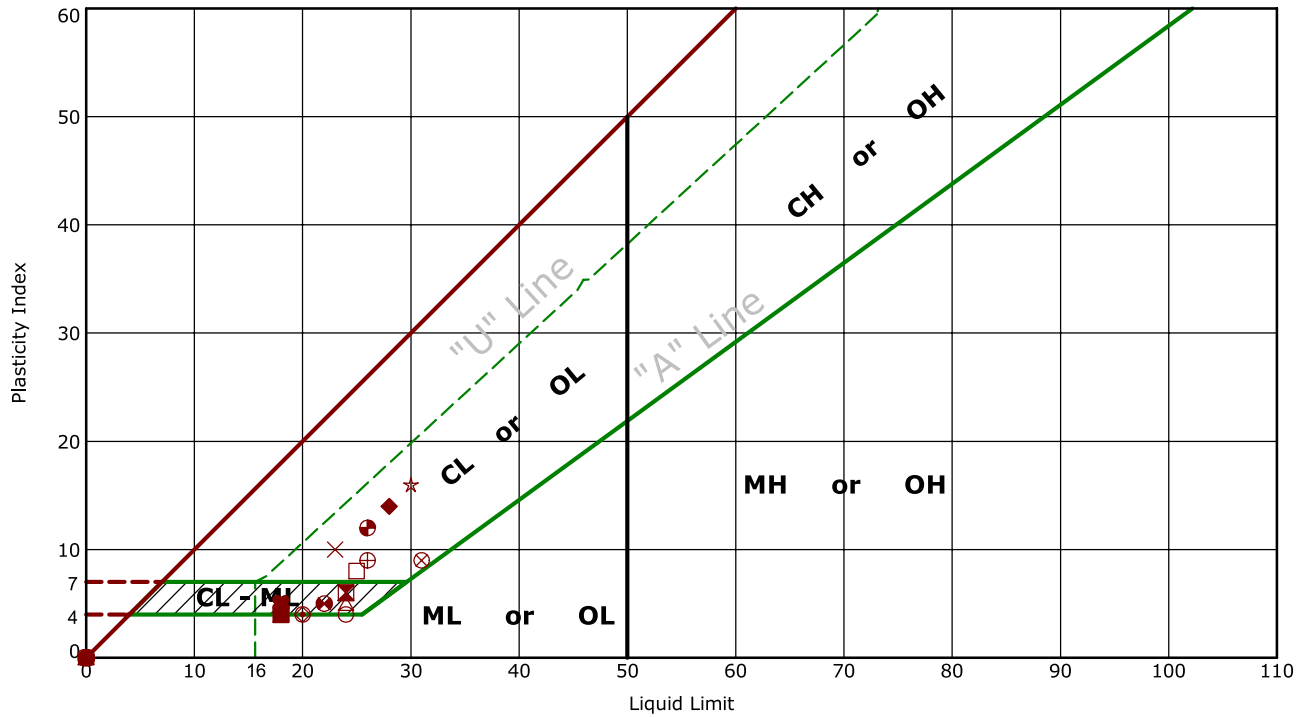
ASTM D4318



	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	FB1	1 - 2.5	28	17	11	22.9	SC	CLAYEY SAND with GRAVEL
⊠	FB1	2.5 - 4	29	18	11	30.4	SC	CLAYEY SAND with GRAVEL
▲	FB1	6 - 7.5	26	21	5	36.9	SC-SM	SILTY, CLAYEY SAND
★	FB1	8.5 - 10	24	16	8	36.3	SC	CLAYEY SAND
⊙	FB1	15 - 17.5	26	23	3	22.4	SM	SILTY SAND
⊕	FB1	20 - 23	22	19	3	32.3	SM	SILTY SAND
○	FB2	0 - 1.5	27	19	8	26.4	SC	CLAYEY SAND with GRAVEL
△	FB2	3 - 8	NP	NP	NP	27.7	SM	SILTY SAND
⊗	FB2	9 - 10	23	17	6	31.6	SC-SM	SILTY, CLAYEY SAND with GRAVEL
⊕	FB2	18 - 20	26	20	6	30.1	SC-SM	SILTY, CLAYEY SAND
□	FB2	31 - 34	25	18	7	23.1	SC-SM	SILTY, CLAYEY SAND with GRAVEL
⊕	MB1	0 - 2.5	NP	NP	NP	8.2	GW-GM	WELL-GRADED GRAVEL with SILT and SAND
⊕	MB1	2.5 - 5	24	18	6	20.9	GC-GM	SILTY, CLAYEY GRAVEL with SAND
★	MB1	5 - 7.5	25	16	9	27.6	GC	CLAYEY GRAVEL with SAND
⊗	MB1	5 - 6	NP	NP	NP	13.2	SM	SILTY SAND with GRAVEL
■	MB1	7.5 - 10	25	20	5	36.5	SC-SM	SILTY, CLAYEY SAND with GRAVEL
◆	MB1	10 - 12.5	28	16	12	49.1	SC	CLAYEY SAND
◇	MB1	10 - 11	NP	NP	NP	11.2	SM	SILTY SAND
×	MB1	20 - 25	25	19	6	38.3	SC-SM	SILTY, CLAYEY SAND with GRAVEL
⊕	MB1	30 - 35	23	17	6	48.0	SC-SM	SILTY, CLAYEY SAND

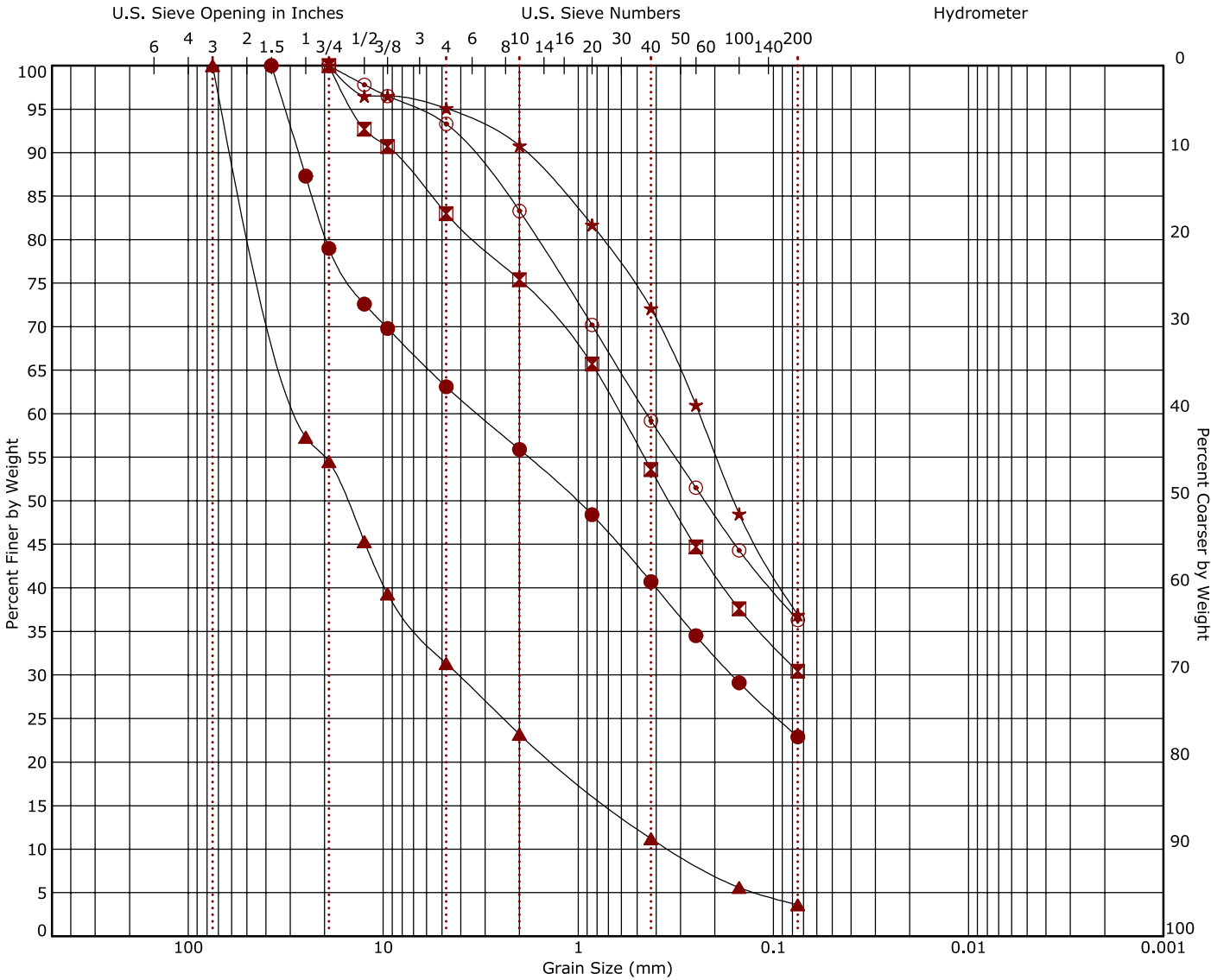
Atterberg Limit Results

ASTM D4318



	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	MB2	0 - 2.5	NP	NP	NP	9.0	SW-SM	WELL GRADED SAND with SILT and GRAVEL
⊠	MB2	2.5 - 5	24	18	6	12.4	SC-SM	SILTY, CLAYEY SAND with GRAVEL
▲	MB2	2.5 - 3.5	NP	NP	NP	7.2	GP-GM	POORLY GRADED GRAVEL with SILT and SAND
★	MB2	5 - 7.5	NP	NP	NP	16.9	GM	SILTY GRAVEL with SAND
⊙	MB2	7.5 - 10	20	16	4	25.3	SC-SM	SILTY CLAYEY SAND with GRAVEL
⊕	MB2	7.5 - 8.5	NP	NP	NP	7.4	GP-GM	POORLY GRADED GRAVEL with SILT and SAND
○	MB2	12 - 13	24	20	4	33.6	SC-SM	SILTY, CLAYEY SAND with GRAVEL
△	MB2	15 - 16.5	24	19	5	29.6	SC-SM	SILTY, CLAYEY SAND with GRAVEL
⊗	MB2	17 - 18	31	22	9	40.8	SC	CLAYEY SAND
⊕	MB2	17.5 - 20	26	17	9	53.0	CL	SANDY LEAN CLAY
□	MB2	20 - 21.5	25	17	8	51.8	CL	SANDY LEAN CLAY
⊕	MB2	30 - 35	22	17	5	44.3	SC-SM	SILTY, CLAYEY SAND
⊕	P1	1 - 4	26	14	12	33.7	SC	CLAYEY SAND with GRAVEL
★	P2	1 - 4	30	14	16	39.0	SC	CLAYEY SAND with GRAVEL
⊗	P3	1 - 4	NP	NP	NP	23.4	SM	SILTY SAND with GRAVEL
■	P4	1 - 4	18	14	4	37.1	SC-SM	SILTY, CLAYEY SAND
◆	P5	1 - 4	28	14	14	34.9	SC	CLAYEY SAND with GRAVEL
◇	P6	1 - 4	20	16	4	21.3	SC-SM	SILTY, CLAYEY SAND with GRAVEL
×	P7	1 - 4	23	13	10	26.4	SC	CLAYEY SAND with GRAVEL
⊕	P8	1 - 4	18	13	5	20.1	SC-SM	SILTY, CLAYEY SAND with GRAVEL

Grain Size Distribution
ASTM D422 / ASTM C136 / AASHTO T27

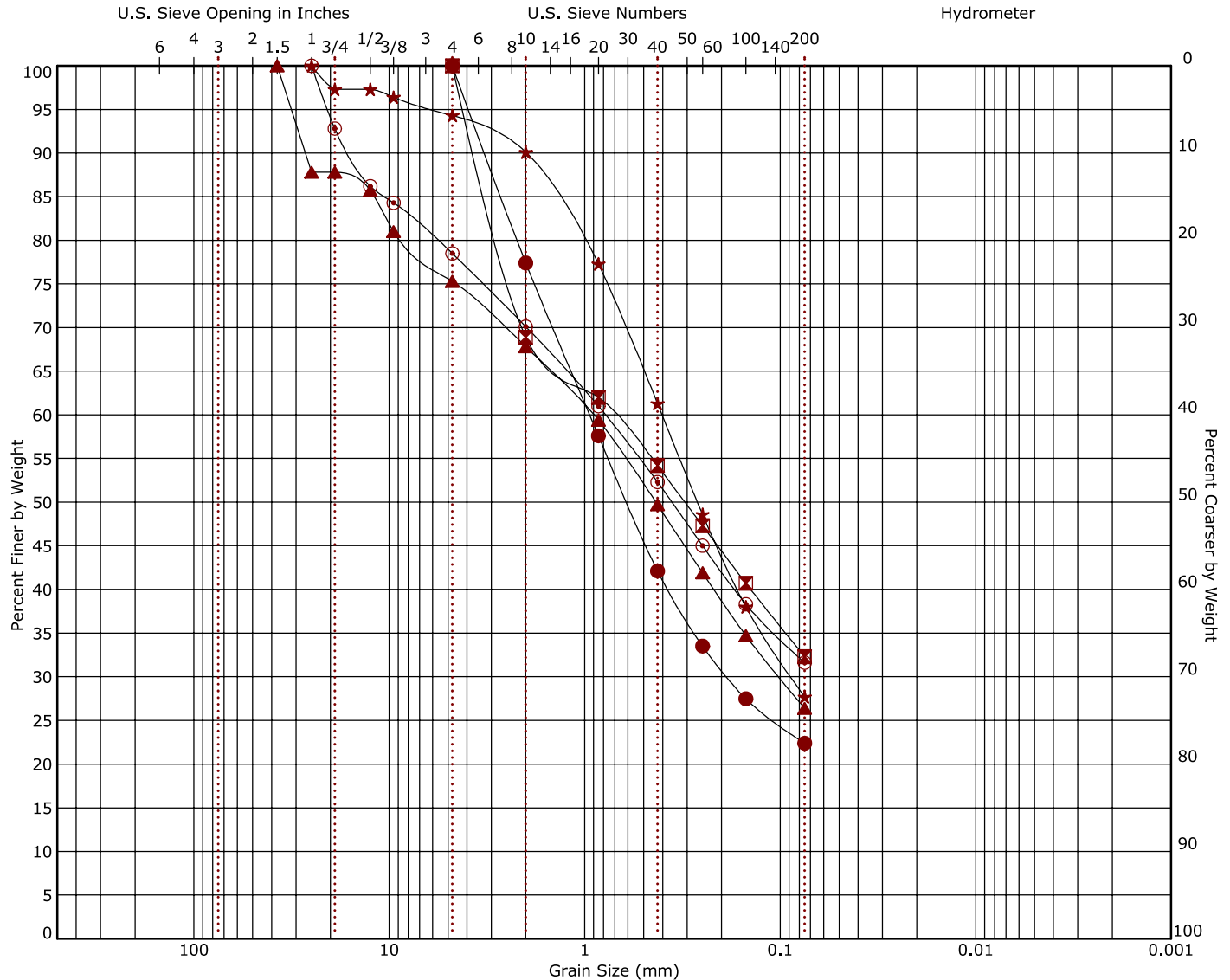


Boring ID	Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
● FB1	1 - 2.5	CLAYEY SAND with GRAVEL	SC	28	17	11		
⊠ FB1	2.5 - 4	CLAYEY SAND with GRAVEL	SC	29	18	11		
▲ FB1	5 - 5.5	WELL GRADED GRAVEL with SAND	GW				1.88	78.82
★ FB1	6 - 7.5	SILTY, CLAYEY SAND	SC-SM	26	21	5		
⊙ FB1	8.5 - 10	CLAYEY SAND	SC	24	16	8		

Boring ID	Depth (Ft)	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
● FB1	1 - 2.5	37.5	3.273	0.163		0.0	36.9	40.2	22.9		
⊠ FB1	2.5 - 4	19	0.613			0.0	17.0	52.6	30.4		
▲ FB1	5 - 5.5	75	26.798	4.134	0.34	0.0	68.7	27.7	3.6		
★ FB1	6 - 7.5	19	0.24			0.0	4.9	58.2	36.9		
⊙ FB1	8.5 - 10	19	0.447			0.0	6.7	57.0	36.3		

Grain Size Distribution

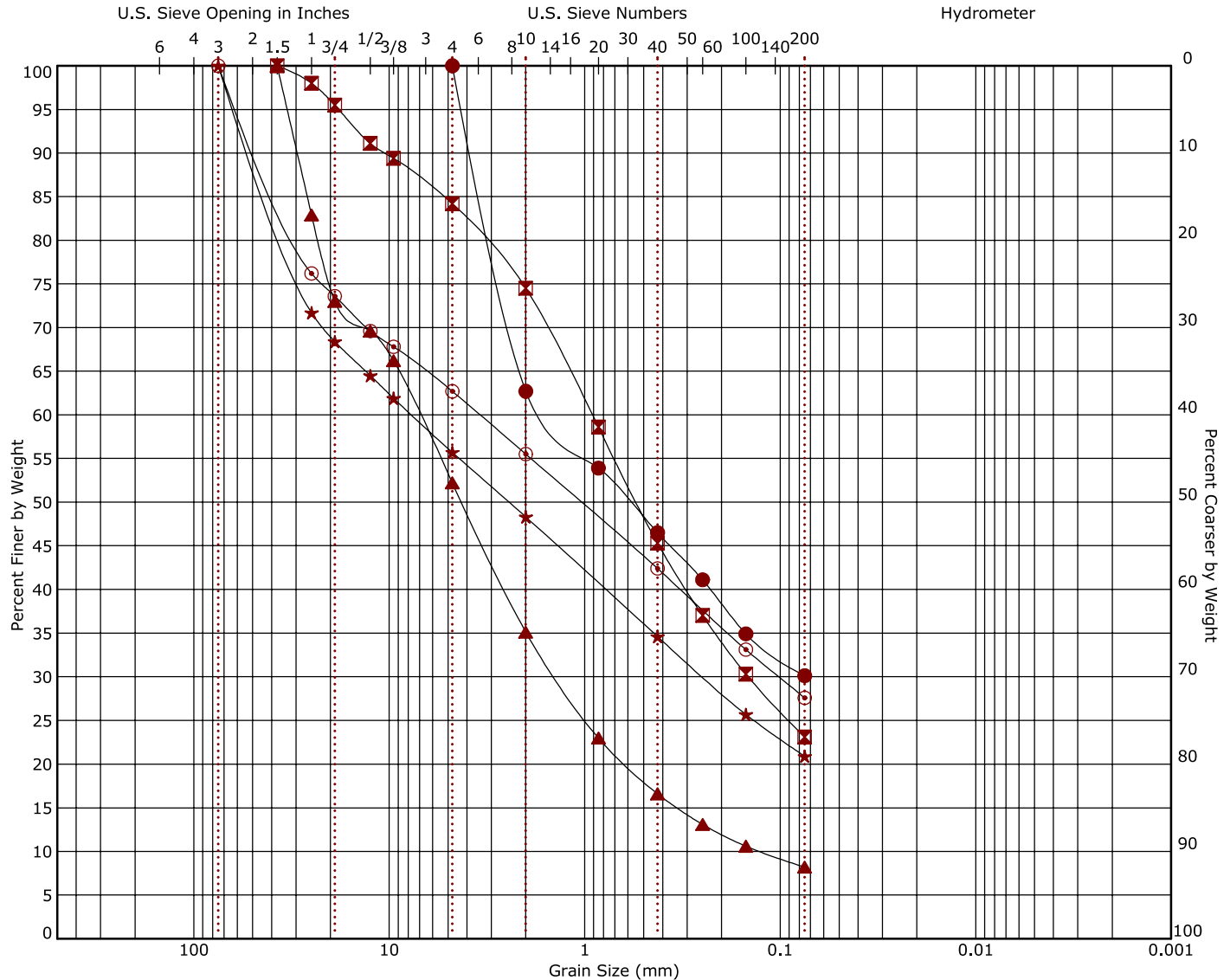
ASTM D422 / ASTM C136 / AASHTO T27



Cobbles		Gravel		Sand			Silt or Clay							
		coarse	fine	coarse	medium	fine								
Boring ID	Depth (Ft)	Description						USCS	LL	PL	PI	Cc	Cu	
●	FB1	15 - 17.5	SILTY SAND						SM	26	23	3		
☒	FB1	20 - 23	SILTY SAND						SM	22	19	3		
▲	FB2	0 - 1.5	CLAYEY SAND with GRAVEL						SC	27	19	8		
★	FB2	3 - 8	SILTY SAND						SM	NP	NP	NP		
⊙	FB2	9 - 10	SILTY, CLAYEY SAND with GRAVEL						SC-SM	23	17	6		
Boring ID	Depth (Ft)	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay			
●	FB1	15 - 17.5	4.75	0.943	0.186		0.0	0.0	77.6	22.4				
☒	FB1	20 - 23	4.75	0.712			0.0	0.0	67.7	32.3				
▲	FB2	0 - 1.5	37.5	0.904	0.101		0.0	24.7	48.9	26.4				
★	FB2	3 - 8	25	0.403	0.088		0.0	5.7	66.6	27.7				
⊙	FB2	9 - 10	25	0.785			0.0	21.5	46.9	31.6				

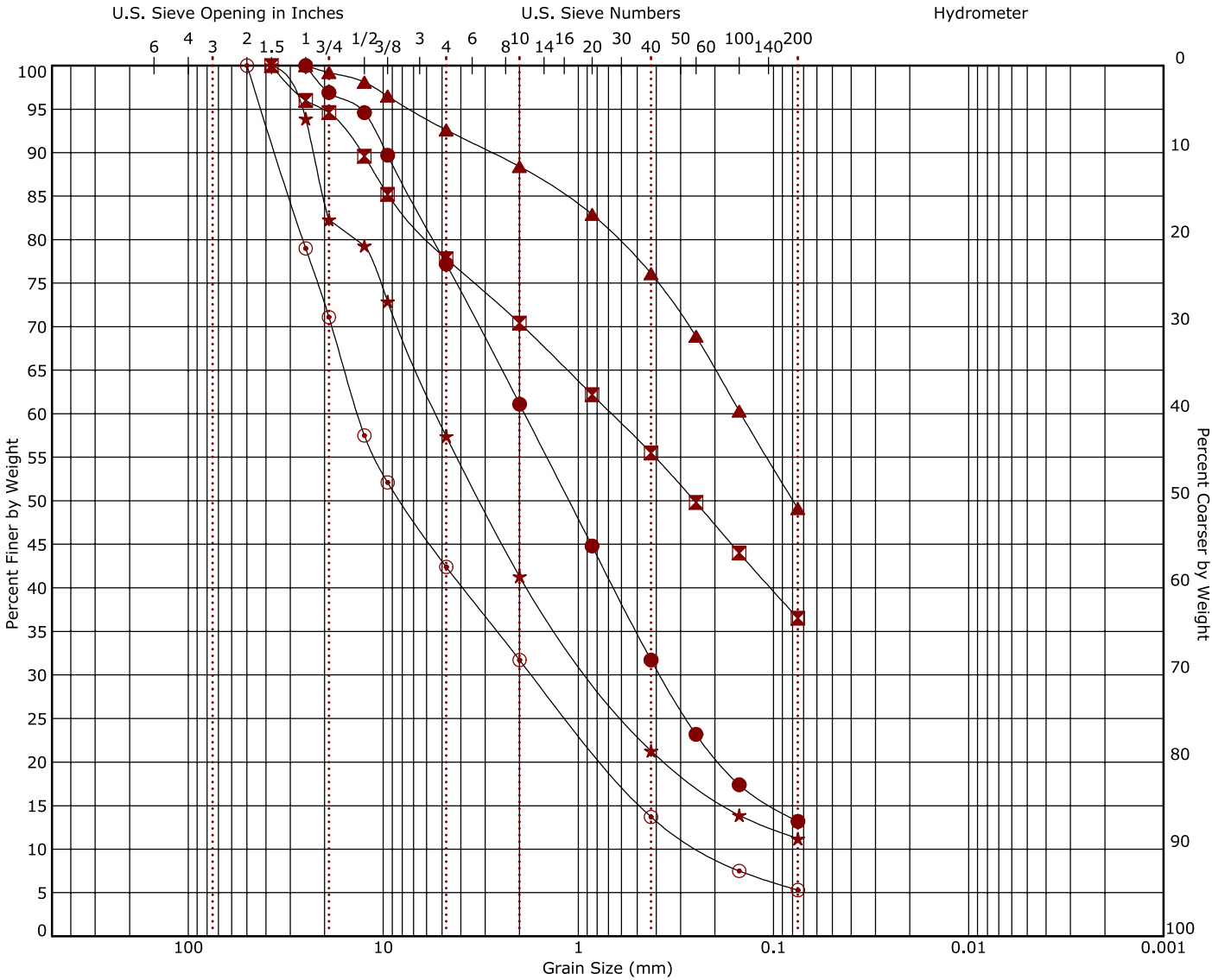
Grain Size Distribution

ASTM D422 / ASTM C136 / AASHTO T27



Cobbles		Gravel		Sand			Silt or Clay							
		coarse	fine	coarse	medium	fine								
Boring ID	Depth (Ft)	Description						USCS	LL	PL	PI	Cc	Cu	
●	FB2	18 - 20	SILTY, CLAYEY SAND						SC-SM	26	20	6		
☒	FB2	31 - 34	SILTY, CLAYEY SAND with GRAVEL						SC-SM	25	18	7		
▲	MB1	0 - 2.5	WELL-GRADED GRAVEL with SILT and SAND						GW-GM	NP	NP	NP	2.21	55.41
★	MB1	2.5 - 5	SILTY, CLAYEY GRAVEL with SAND						GC-GM	24	18	6		
⊙	MB1	5 - 7.5	CLAYEY GRAVEL with SAND						GC	25	16	9		
Boring ID	Depth (Ft)	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay			
●	FB2	18 - 20	4.75	1.538			0.0	0.0	69.9	30.1				
☒	FB2	31 - 34	37.5	0.917	0.146		0.0	15.8	61.1	23.1				
▲	MB1	0 - 2.5	37.5	6.989	1.394	0.126	0.0	47.8	44.0	8.2				
★	MB1	2.5 - 5	75	7.682	0.248		0.0	44.3	34.8	20.9				
⊙	MB1	5 - 7.5	75	3.434	0.101		0.0	37.3	35.1	27.6				

Grain Size Distribution
ASTM D422 / ASTM C136 / AASHTO T27

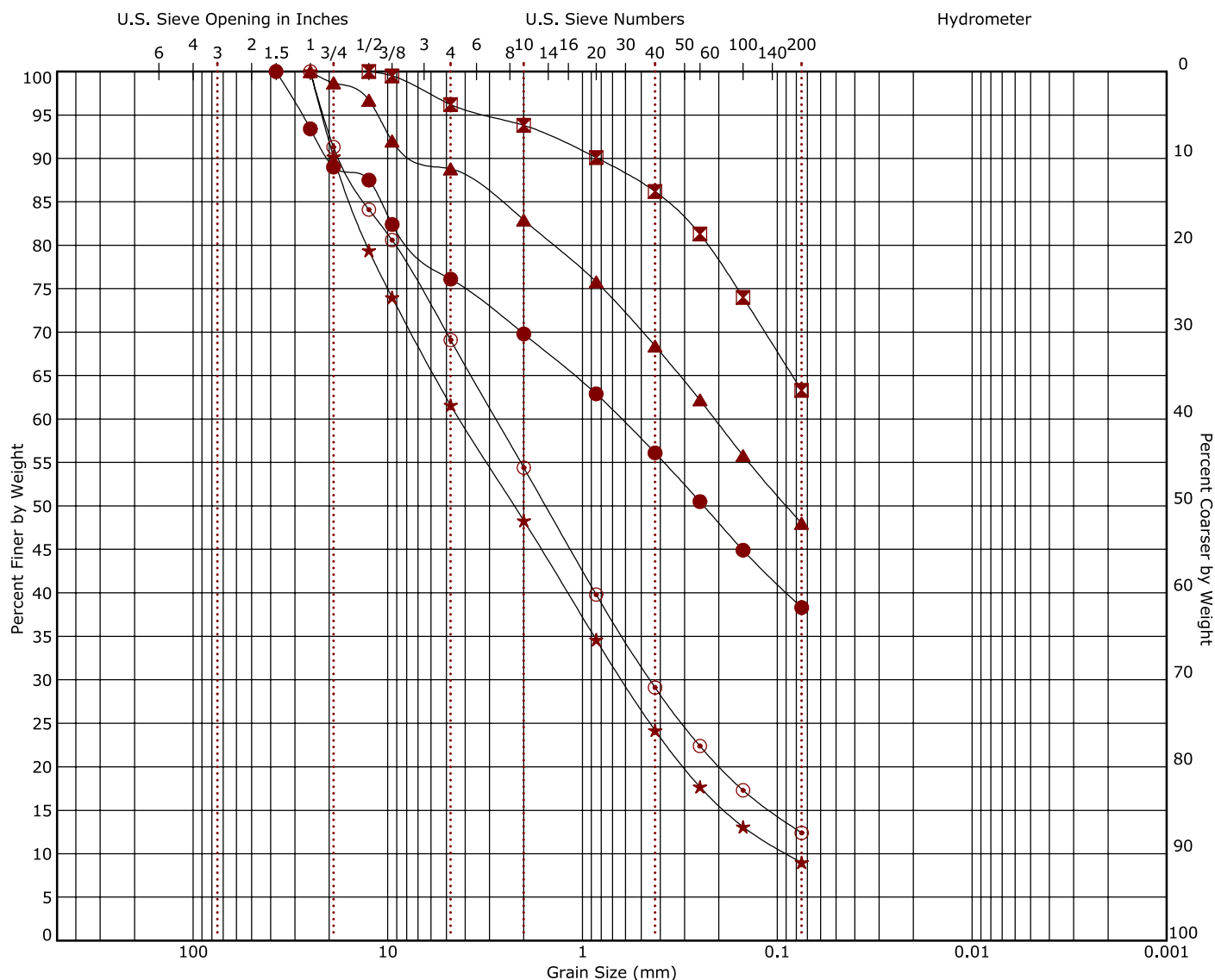


Boring ID	Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
● MB1	5 - 6	SILTY SAND with GRAVEL	SM	NP	NP	NP		
☒ MB1	7.5 - 10	SILTY, CLAYEY SAND with GRAVEL	SC-SM	25	20	5		
▲ MB1	10 - 12.5	CLAYEY SAND	SC	28	16	12		
★ MB1	10 - 11	SILTY SAND	SM	NP	NP	NP	2.36	96.81
◎ MB1	15 - 15.5	POORLY GRADED GRAVEL with SAND	GP				0.97	59.14

Boring ID	Depth (Ft)	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
● MB1	5 - 6	25	1.888	0.382		0.0	22.8	64.0	13.2		
☒ MB1	7.5 - 10	37.5	0.677			0.0	22.2	41.3	36.5		
▲ MB1	10 - 12.5	25	0.147			0.0	7.4	43.5	49.1		
★ MB1	10 - 11	37.5	5.336	0.834		0.0	42.6	46.2	11.2		
◎ MB1	15 - 15.5	50	13.5	1.728	0.228	0.0	57.6	37.1	5.3		

Grain Size Distribution

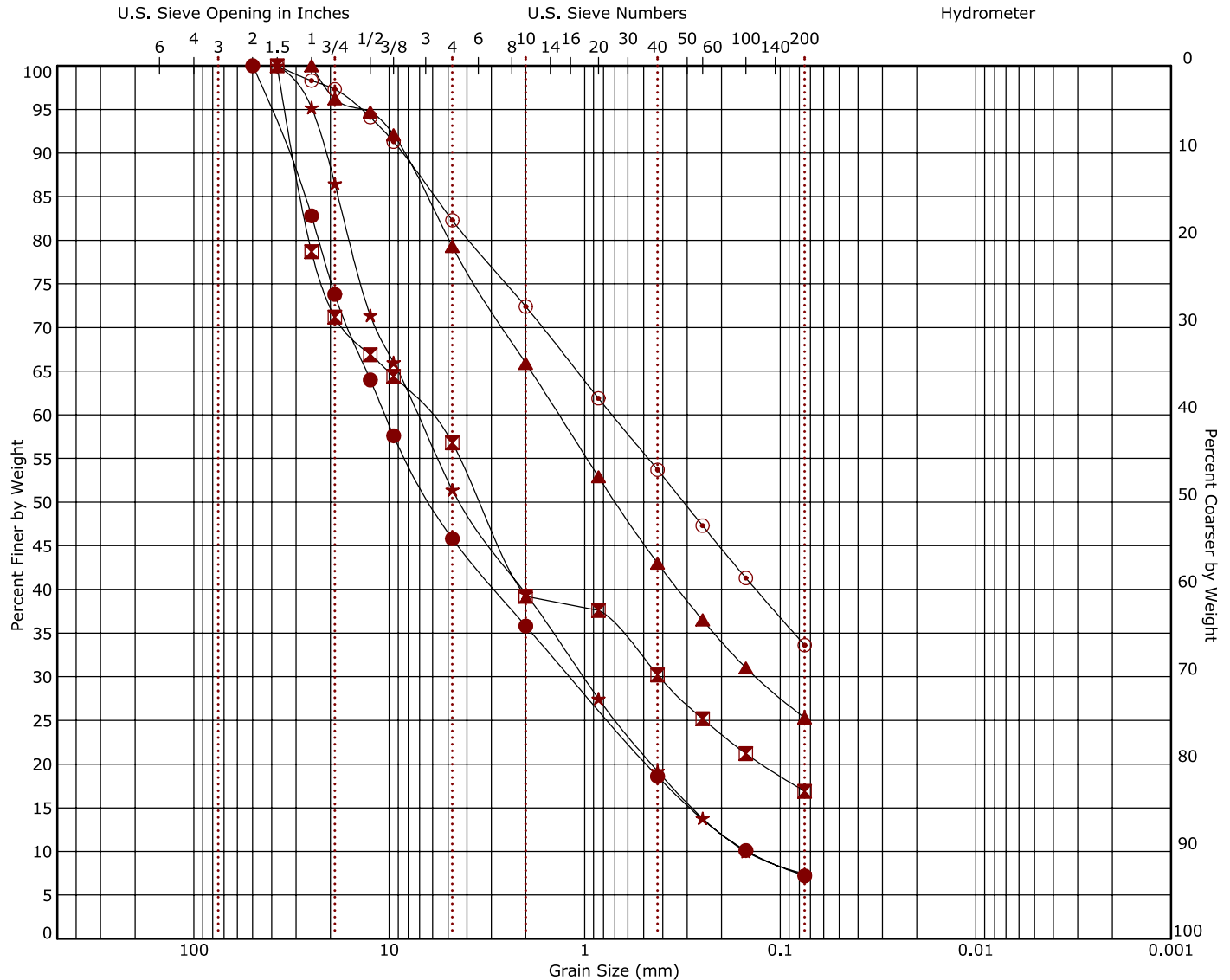
ASTM D422 / ASTM C136 / AASHTO T27



Cobbles		Gravel		Sand			Silt or Clay							
		coarse	fine	coarse	medium	fine								
Boring ID	Depth (Ft)	Description						USCS	LL	PL	PI	Cc	Cu	
●	MB1	20 - 25	SILTY, CLAYEY SAND with GRAVEL						SC-SM	25	19	6		
☒	MB1	20 - 21	SANDY SILTY CLAY						CL-ML					
▲	MB1	30 - 35	SILTY, CLAYEY SAND						SC-SM	23	17	6		
★	MB2	0 - 2.5	WELL GRADED SAND with SILT and GRAVEL						SW-SM	NP	NP	NP	1.03	48.20
⊙	MB2	2.5 - 5	SILTY, CLAYEY SAND with GRAVEL						SC-SM	24	18	6	1.37	52.06
Boring ID	Depth (Ft)	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay			
●	MB1	20 - 25	37.5	0.632		0.0	23.9	37.8	38.3					
☒	MB1	20 - 21	12.5			0.0	3.8	32.9	63.3					
▲	MB1	30 - 35	25	0.21		0.0	11.2	40.8	48.0					
★	MB2	0 - 2.5	25	4.281	0.626	0.089	0.0	38.4	52.6	9.0				
⊙	MB2	2.5 - 5	25	2.781	0.451	0.0	30.9	56.7	12.4					

Grain Size Distribution

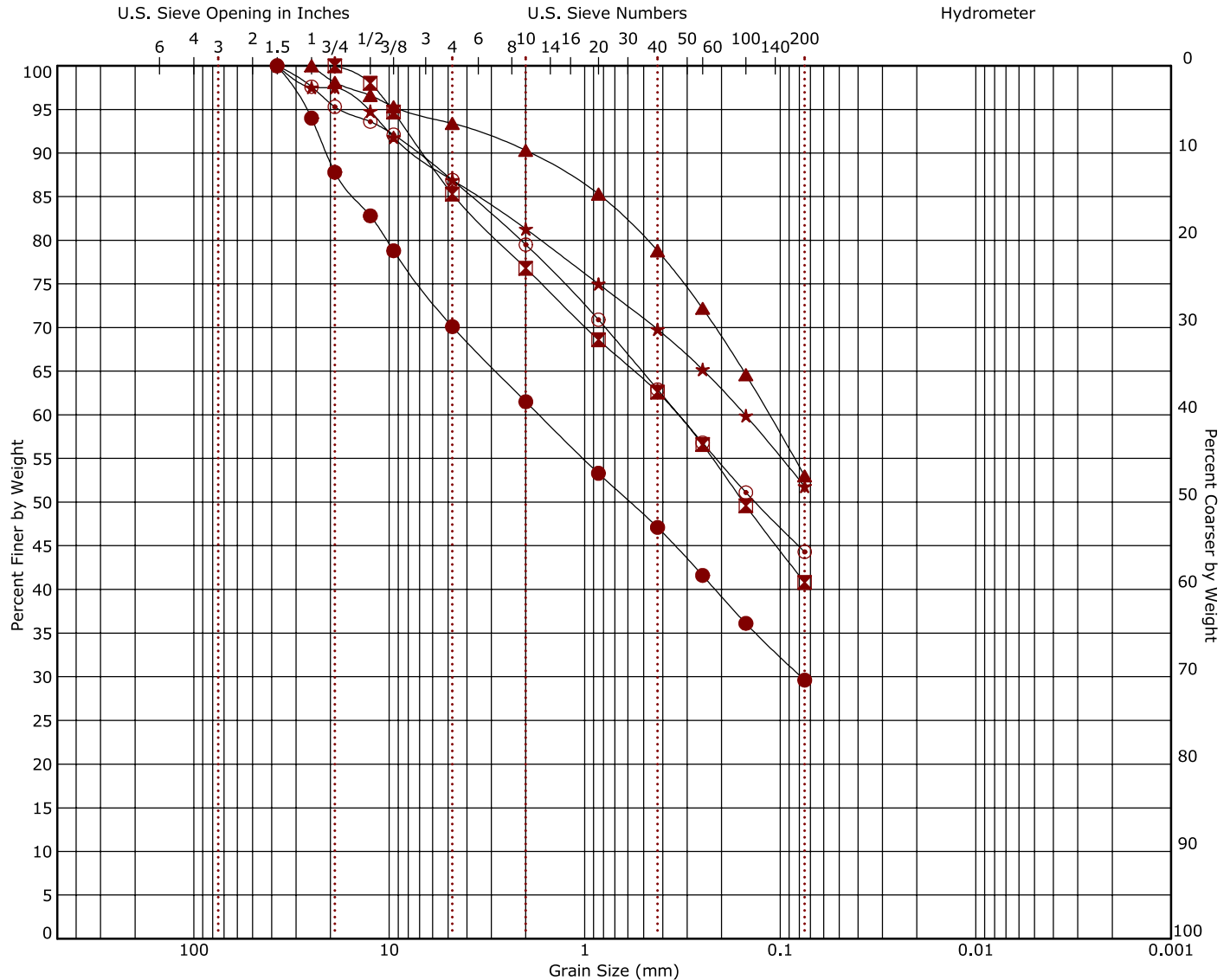
ASTM D422 / ASTM C136 / AASHTO T27



Cobbles		Gravel		Sand			Silt or Clay						
		coarse	fine	coarse	medium	fine							
Boring ID	Depth (Ft)	Description						USCS	LL	PL	PI	Cc	Cu
● MB2	2.5 - 3.5	POORLY GRADED GRAVEL with SILT and SAND						GP-GM	NP	NP	NP	0.91	71.90
⊠ MB2	5 - 7.5	SILTY GRAVEL with SAND						GM	NP	NP	NP		
▲ MB2	7.5 - 10	SILTY CLAYEY SAND with GRAVEL						SC-SM	20	16	4		
★ MB2	7.5 - 8.5	POORLY GRADED GRAVEL with SILT and SAND						GP-GM	NP	NP	NP	0.96	47.63
⊙ MB2	12 - 13	SILTY, CLAYEY SAND with GRAVEL						SC-SM	24	20	4		
Boring ID	Depth (Ft)	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay		
● MB2	2.5 - 3.5	50	10.53	1.186	0.146	0.0	54.2	38.6	7.2				
⊠ MB2	5 - 7.5	37.5	6.36	0.416		0.0	43.2	39.9	16.9				
▲ MB2	7.5 - 10	25	1.356	0.133		0.0	20.7	54.0	25.3				
★ MB2	7.5 - 8.5	37.5	7.145	1.016	0.15	0.0	48.6	44.0	7.4				
⊙ MB2	12 - 13	37.5	0.724			0.0	17.7	48.7	33.6				

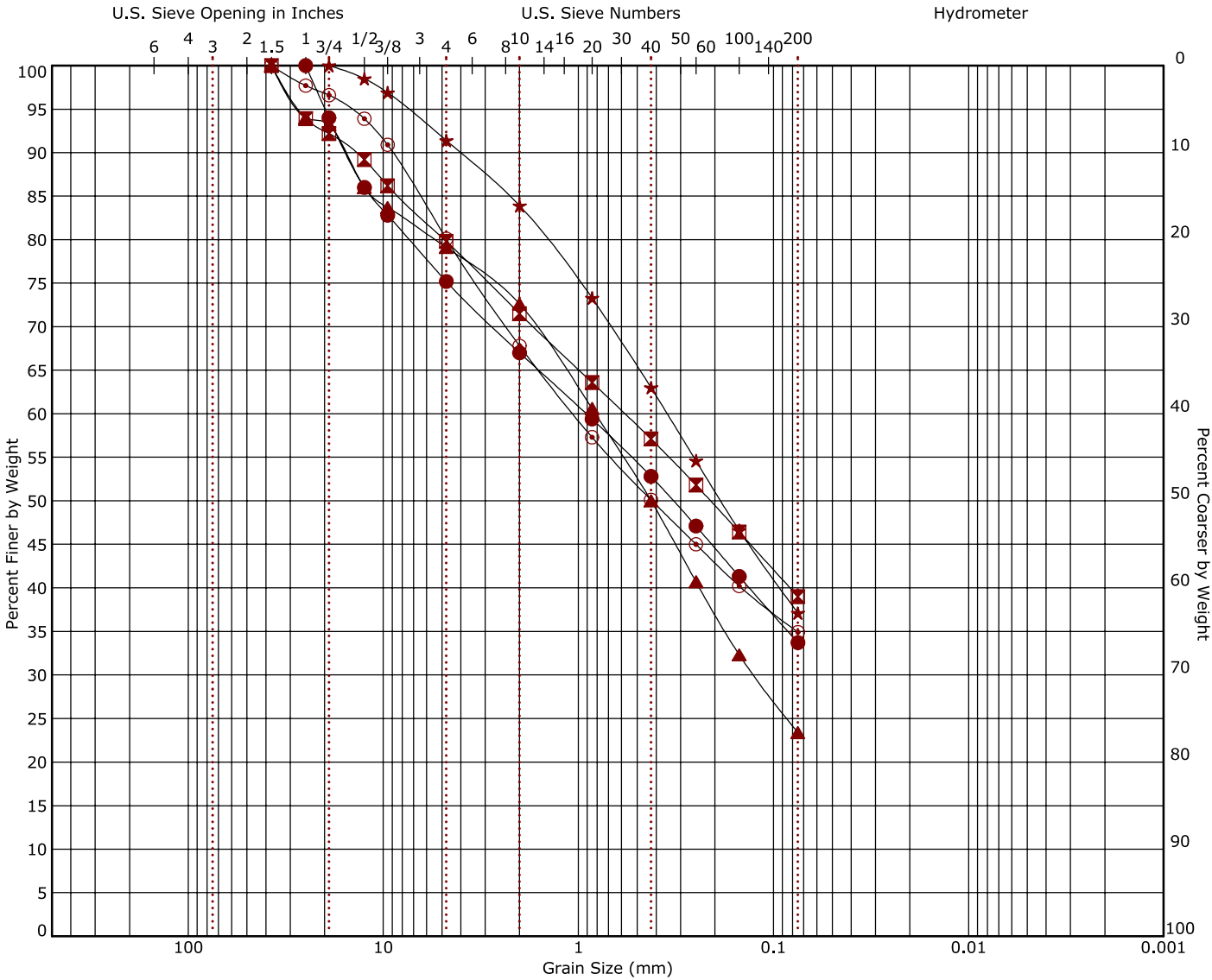
Grain Size Distribution

ASTM D422 / ASTM C136 / AASHTO T27



Cobbles		Gravel		Sand			Silt or Clay						
		coarse	fine	coarse	medium	fine							
Boring ID	Depth (Ft)	Description						USCS	LL	PL	PI	Cc	Cu
● MB2	15 - 16.5	SILTY, CLAYEY SAND with GRAVEL						SC-SM	24	19	5		
⊠ MB2	17 - 18	CLAYEY SAND						SC	31	22	9		
▲ MB2	17.5 - 20	SANDY LEAN CLAY						CL	26	17	9		
★ MB2	20 - 21.5	SANDY LEAN CLAY						CL	25	17	8		
⊙ MB2	30 - 35	SILTY, CLAYEY SAND						SC-SM	22	17	5		
Boring ID	Depth (Ft)	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay		
● MB2	15 - 16.5	37.5	1.71	0.078		0.0	29.9	40.5	29.6				
⊠ MB2	17 - 18	19	0.338			0.0	14.7	44.5	40.8				
▲ MB2	17.5 - 20	25	0.114			0.0	6.6	40.4	53.0				
★ MB2	20 - 21.5	37.5	0.151			0.0	13.1	35.1	51.8				
⊙ MB2	30 - 35	37.5	0.33			0.0	13.1	42.6	44.3				

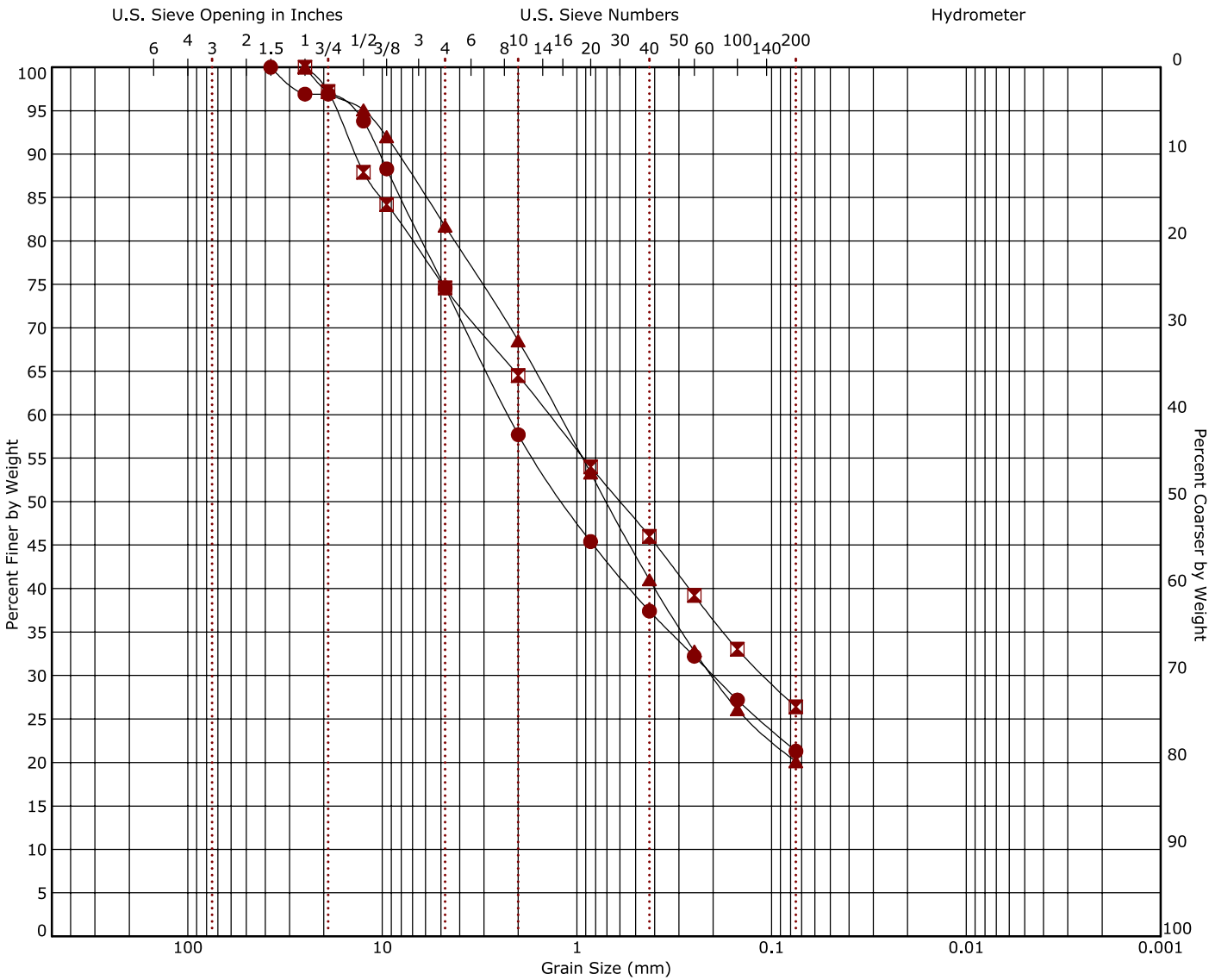
Grain Size Distribution
ASTM D422 / ASTM C136 / AASHTO T27



Boring ID	Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
● P1	1 - 4	CLAYEY SAND with GRAVEL	SC	26	14	12		
⊠ P2	1 - 4	CLAYEY SAND with GRAVEL	SC	30	14	16		
▲ P3	1 - 4	SILTY SAND with GRAVEL	SM	NP	NP	NP		
★ P4	1 - 4	SILTY, CLAYEY SAND	SC-SM	18	14	4		
⊙ P5	1 - 4	CLAYEY SAND with GRAVEL	SC	28	14	14		

Boring ID	Depth (Ft)	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
● P1	1 - 4	25	0.909			0.0	24.8	41.5	33.7		
⊠ P2	1 - 4	37.5	0.579			0.0	20.2	40.8	39.0		
▲ P3	1 - 4	37.5	0.817	0.125		0.0	20.9	55.7	23.4		
★ P4	1 - 4	19	0.352			0.0	8.6	54.3	37.1		
⊙ P5	1 - 4	37.5	1.059			0.0	19.9	45.2	34.9		

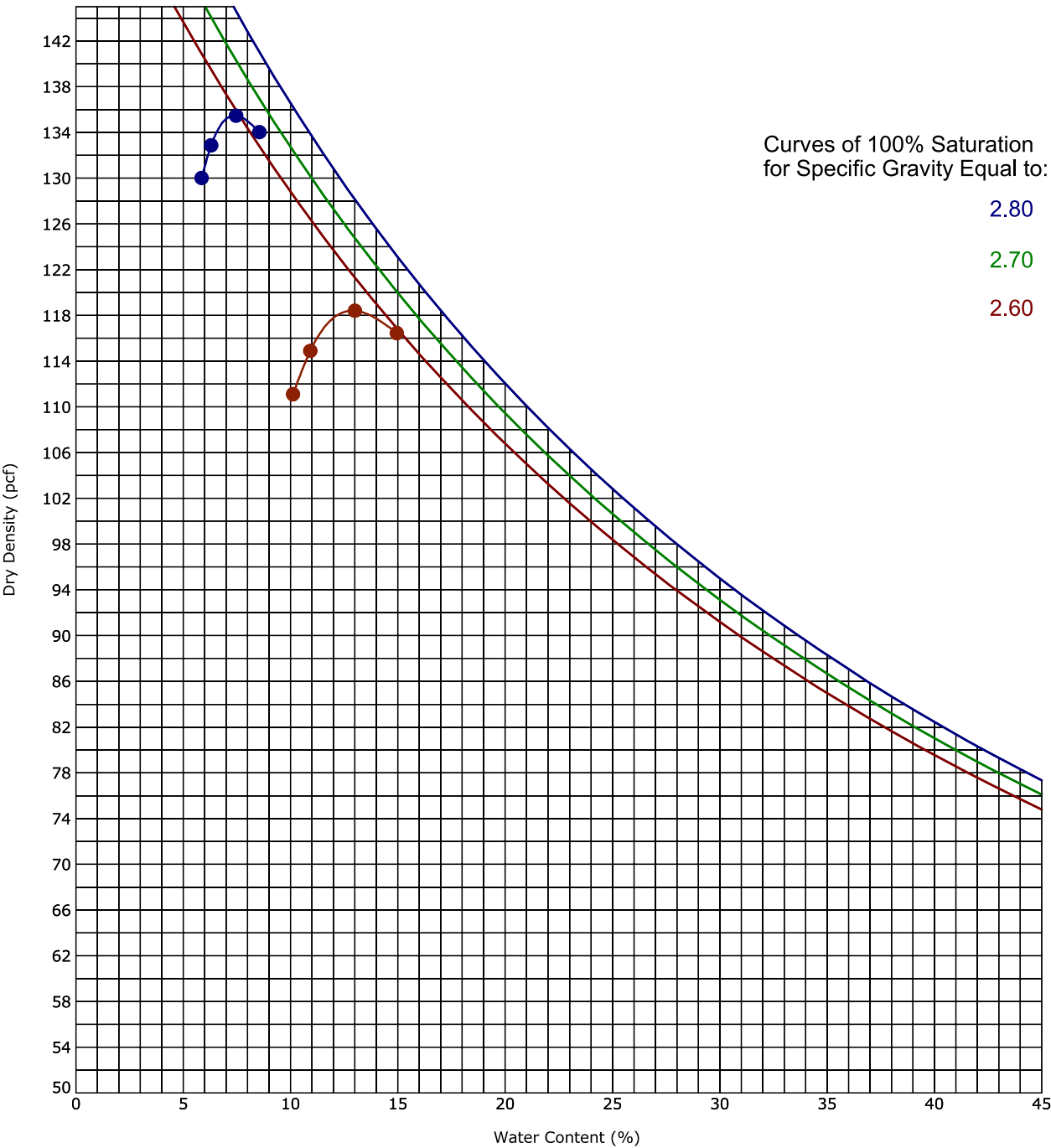
Grain Size Distribution
ASTM D422 / ASTM C136 / AASHTO T27



Cobbles		Gravel		Sand			Silt or Clay						
		coarse	fine	coarse	medium	fine							
Boring ID		Depth (Ft)	Description					USCS	LL	PL	PI	Cc	Cu
●	P6	1 - 4	SILTY, CLAYEY SAND with GRAVEL					SC-SM	20	16	4		
▣	P7	1 - 4	CLAYEY SAND with GRAVEL					SC	23	13	10		
▲	P8	1 - 4	SILTY, CLAYEY SAND with GRAVEL					SC-SM	18	13	5		
Boring ID		Depth (Ft)	D ₁₀₀	D ₆₀	D ₃₀	D ₁₀	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay	
●	P6	1 - 4	37.5	2.25	0.2		0.0	25.4	53.3	21.3			
▣	P7	1 - 4	25	1.386	0.109		0.0	25.4	48.2	26.4			
▲	P8	1 - 4	25	1.239	0.202		0.0	18.3	61.6	20.1			

Moisture-Density Relationship

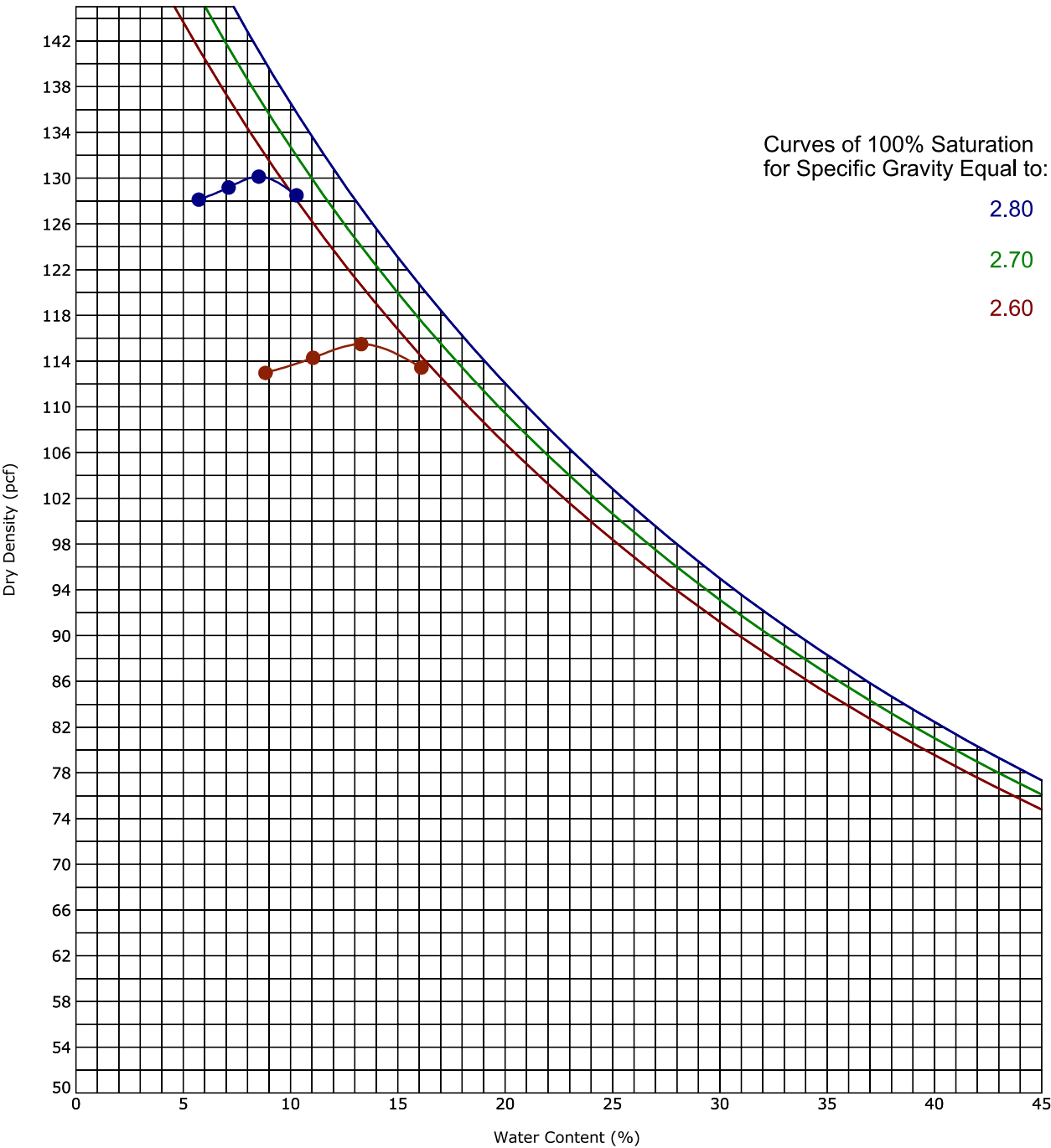
ASTM D698-Method A



Boring ID		Depth (Ft)		Description of Materials					
MB1		2.4999 - 4.9999		SILTY, CLAYEY GRAVEL with SAND(GC-GM)					
						● Uncorrected	● Corrected		
Fines (%)	Fraction >4.75 mm size	LL	PL	PI	Test Method	Max DD (pcf)	Optimum WC (%)	Max DD (pcf)	Optimum WC (%)
21	44.3	24	18	6	ASTM D698-Method A	118.4	12.9	135.5	7.4

Moisture-Density Relationship

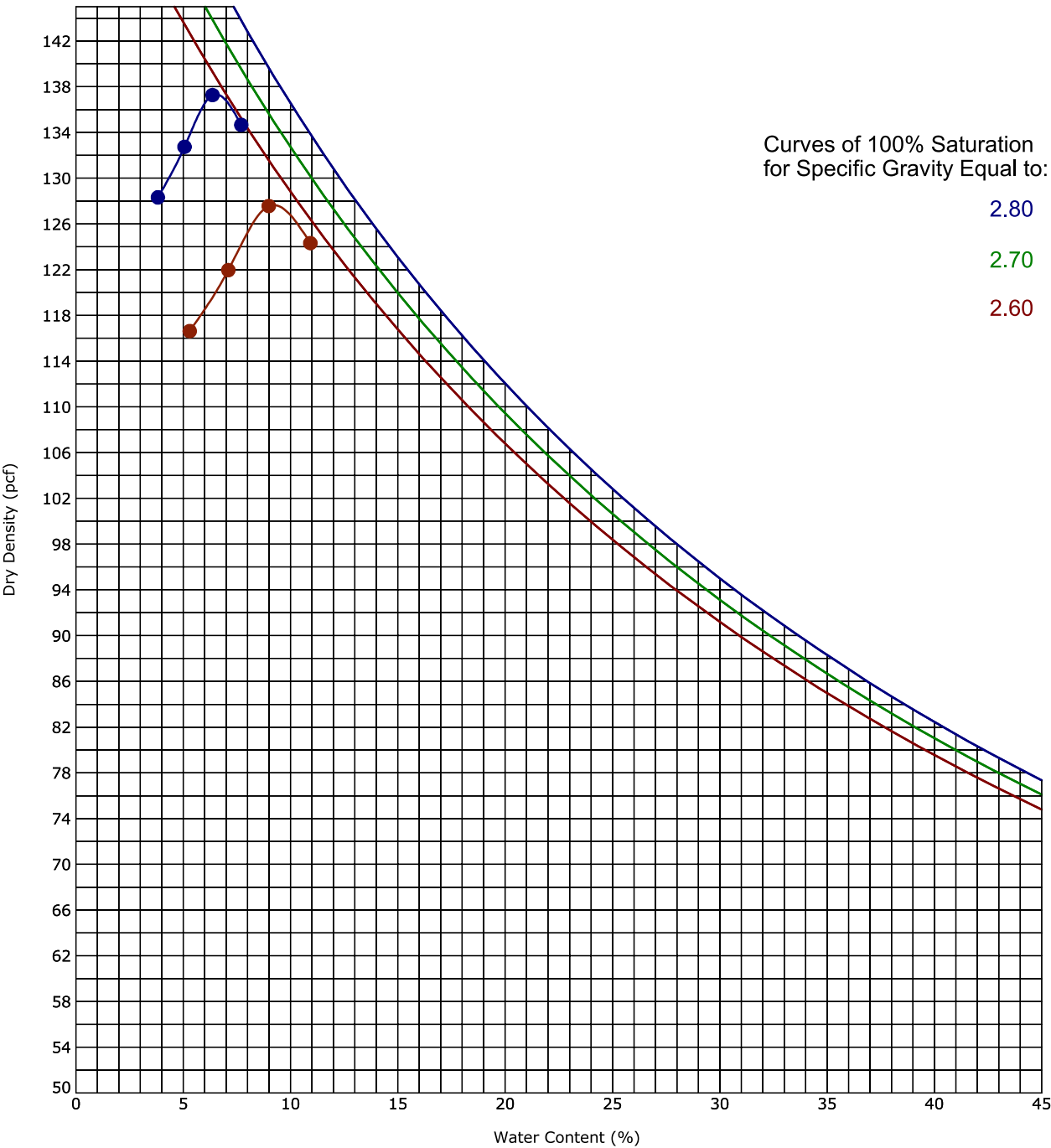
ASTM D698-Method A



Boring ID		Depth (Ft)		Description of Materials					
MB1		4.9999 - 7.4999		CLAYEY GRAVEL with SAND(GC)					
						● Uncorrected	● Corrected		
Fines (%)	Fraction >4.75 mm size	LL	PL	PI	Test Method	Max DD (pcf)	Optimum WC (%)	Max DD (pcf)	Optimum WC (%)
28	37.3	25	16	9	ASTM D698-Method A	115.5	13.3	130.2	8.5

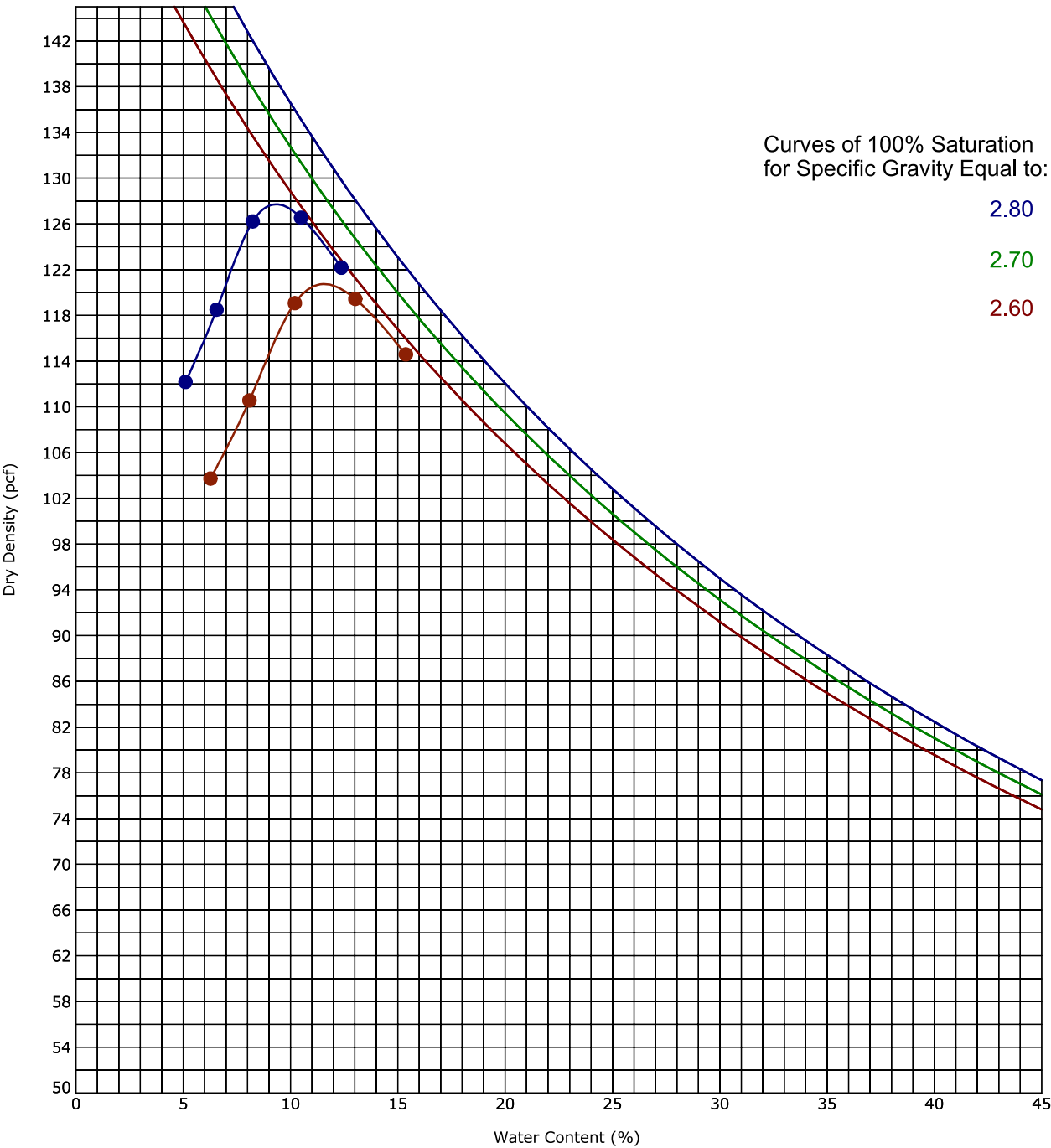
Moisture-Density Relationship

ASTM D698-Method A



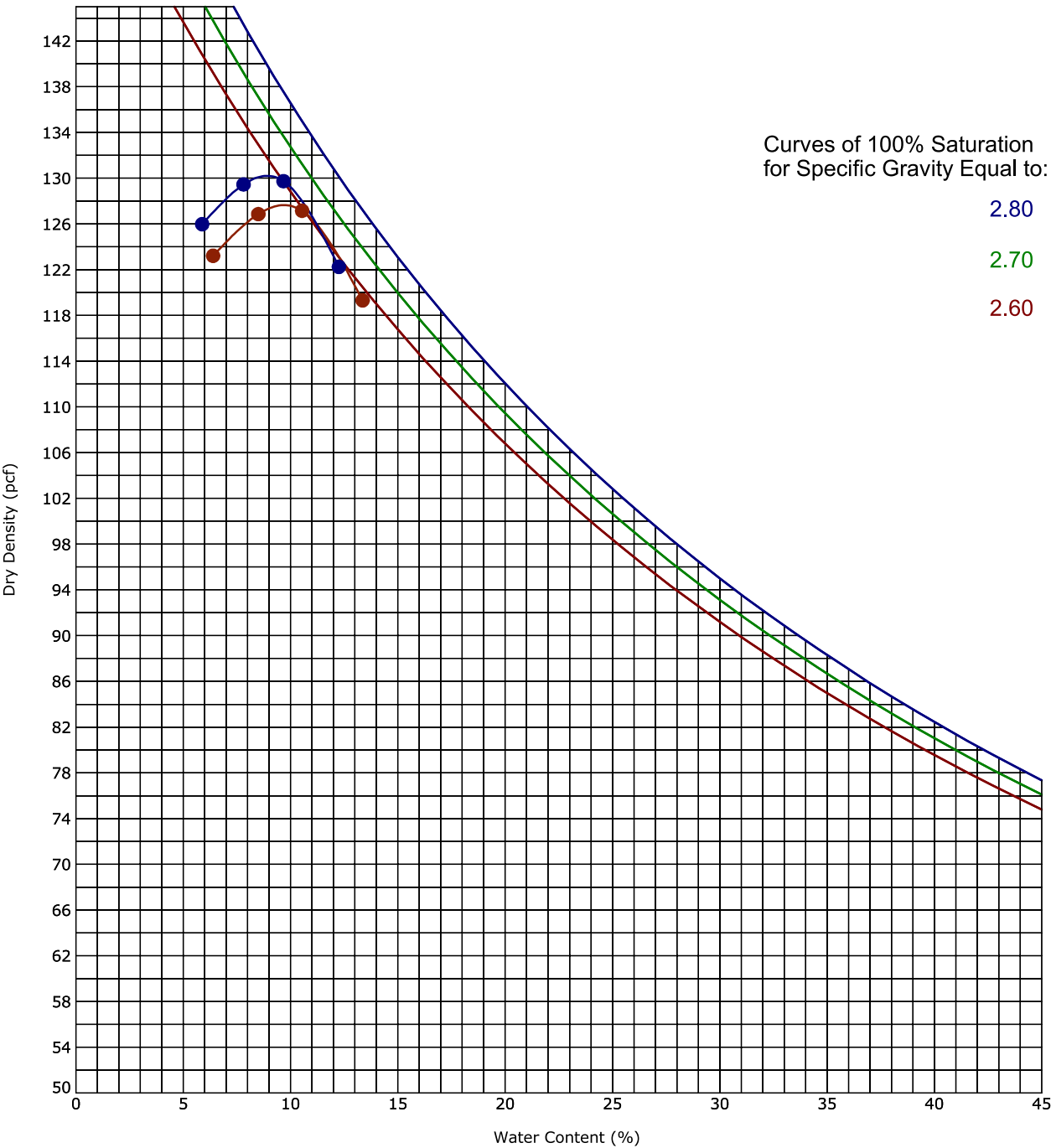
Boring ID		Depth (Ft)		Description of Materials					
MB2		2.49999 - 4.99999		SILTY, CLAYEY SAND with GRAVEL(SC-SM)					
						● Uncorrected		● Corrected	
Fines (%)	Fraction >4.75 mm size	LL	PL	PI	Test Method	Max DD (pcf)	Optimum WC (%)	Max DD (pcf)	Optimum WC (%)
12	30.9	24	18	6	ASTM D698-Method A	127.7	9.2	137.4	6.5

Moisture-Density Relationship
ASTM D698-Method A



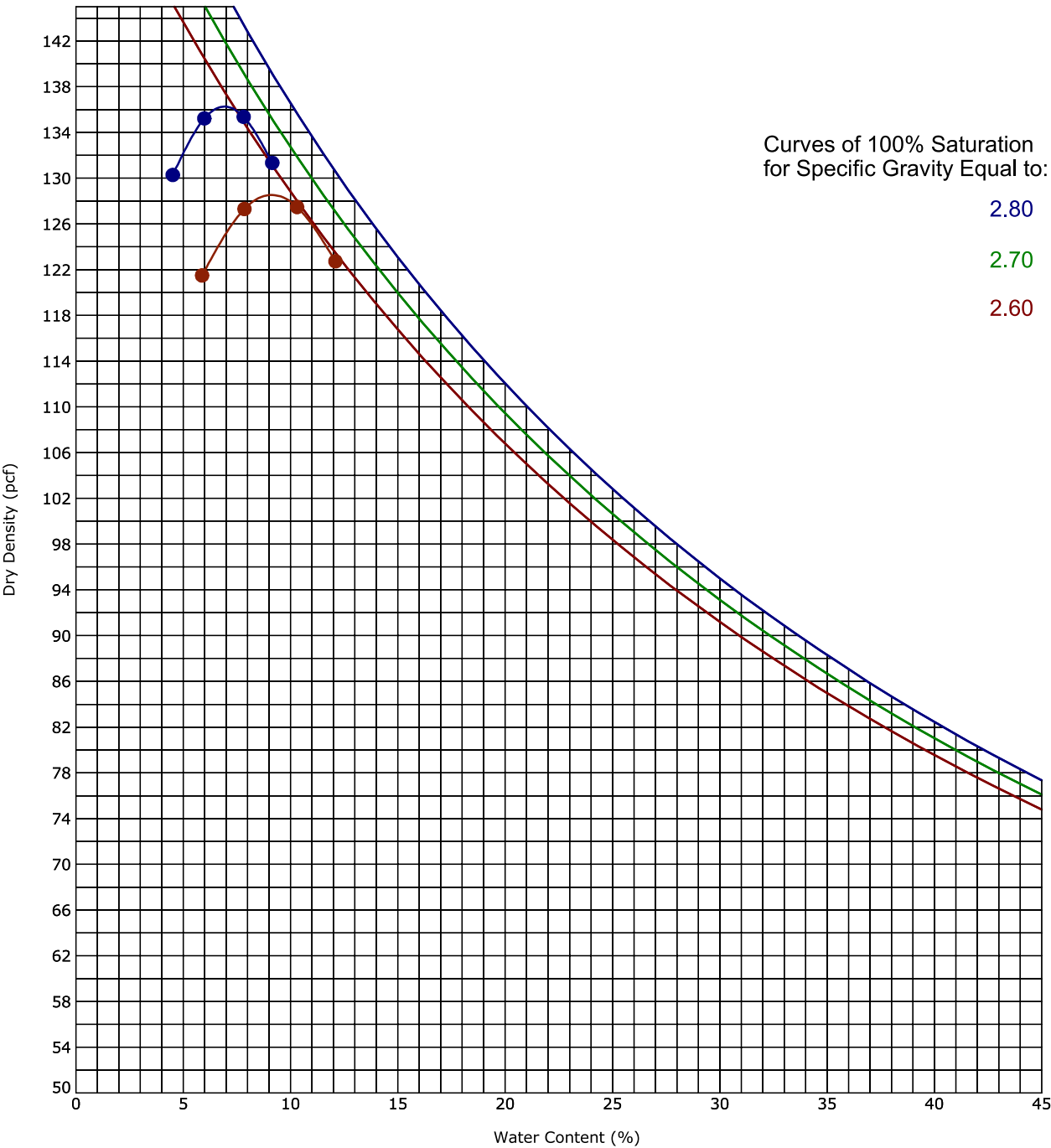
Boring ID		Depth (Ft)		Description of Materials					
P2		1 - 4		CLAYEY SAND with GRAVEL					
						● Uncorrected	● Corrected		
Fines (%)	Fraction >4.75 mm size	LL	PL	PI	Test Method	Max DD (pcf)	Optimum WC (%)	Max DD (pcf)	Optimum WC (%)
39	20.2	30	14	16	ASTM D698-Method A	120.7	11.5	127.7	9.3

Moisture-Density Relationship
ASTM D698-Method A



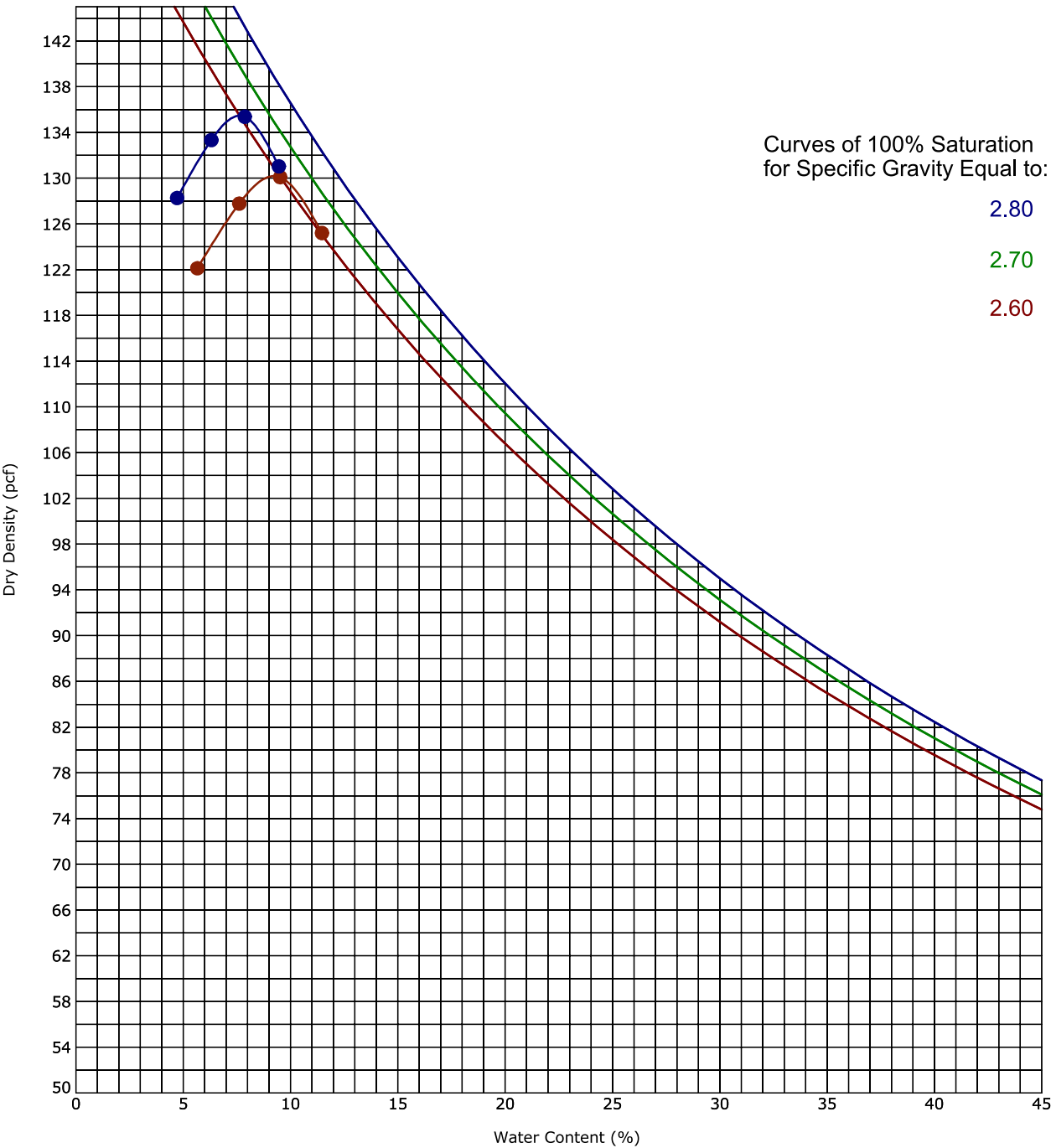
Boring ID		Depth (Ft)		Description of Materials					
P4		1 - 4		SILTY, CLAYEY SAND					
						● Uncorrected		● Corrected	
Fines (%)	Fraction >4.75 mm size	LL	PL	PI	Test Method	Max DD (pcf)	Optimum WC (%)	Max DD (pcf)	Optimum WC (%)
37	8.6	18	14	4	ASTM D698-Method A	127.6	9.7	130.2	8.9

Moisture-Density Relationship
ASTM D698-Method A



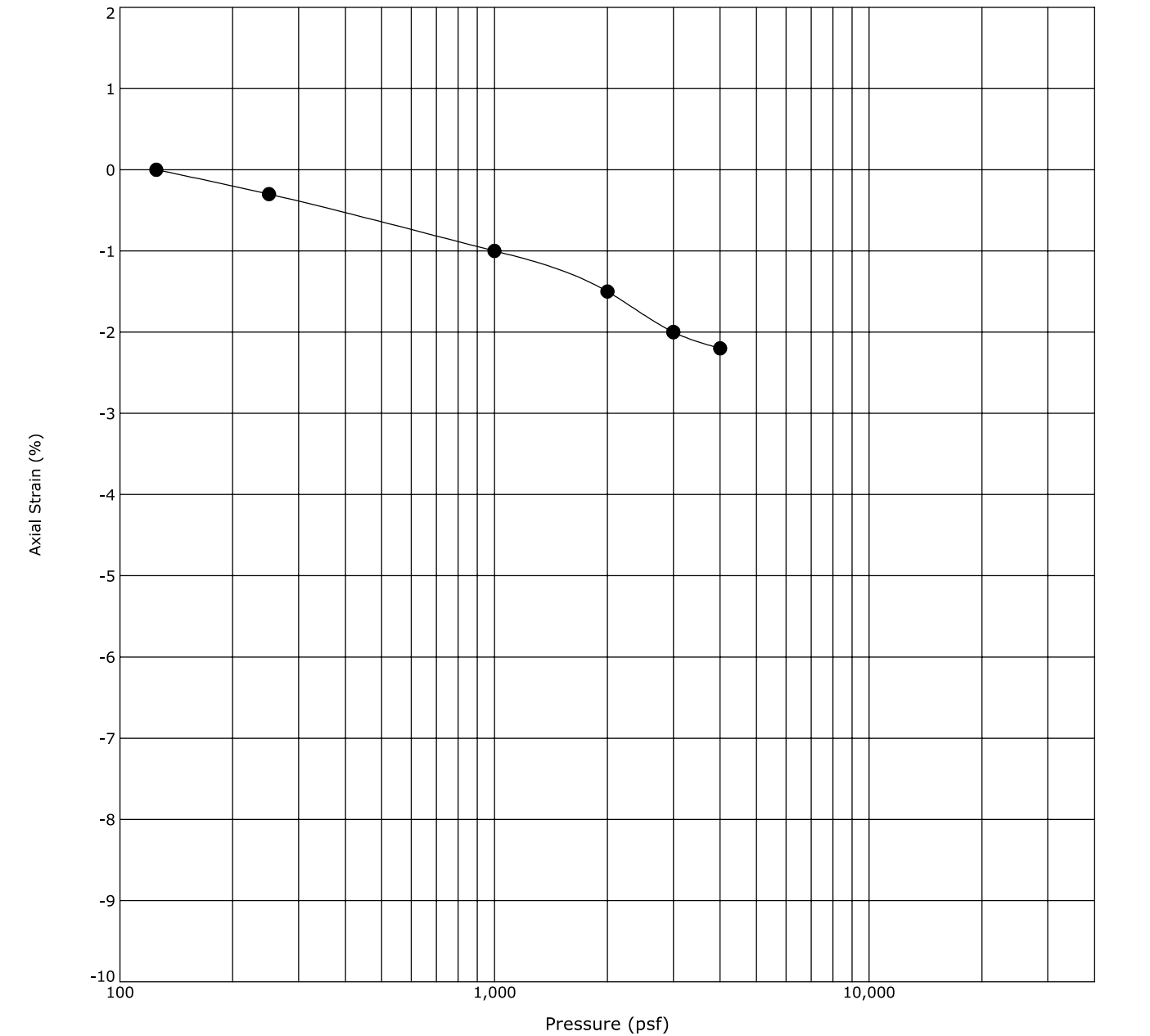
Boring ID		Depth (Ft)		Description of Materials					
P6		1 - 4		SILTY, CLAYEY SAND with GRAVEL					
						● Uncorrected		● Corrected	
Fines (%)	Fraction >4.75 mm size	LL	PL	PI	Test Method	Max DD (pcf)	Optimum WC (%)	Max DD (pcf)	Optimum WC (%)
21	25.4	20	16	4	ASTM D698-Method A	128.5	9.1	136.2	6.9

Moisture-Density Relationship
ASTM D698-Method A



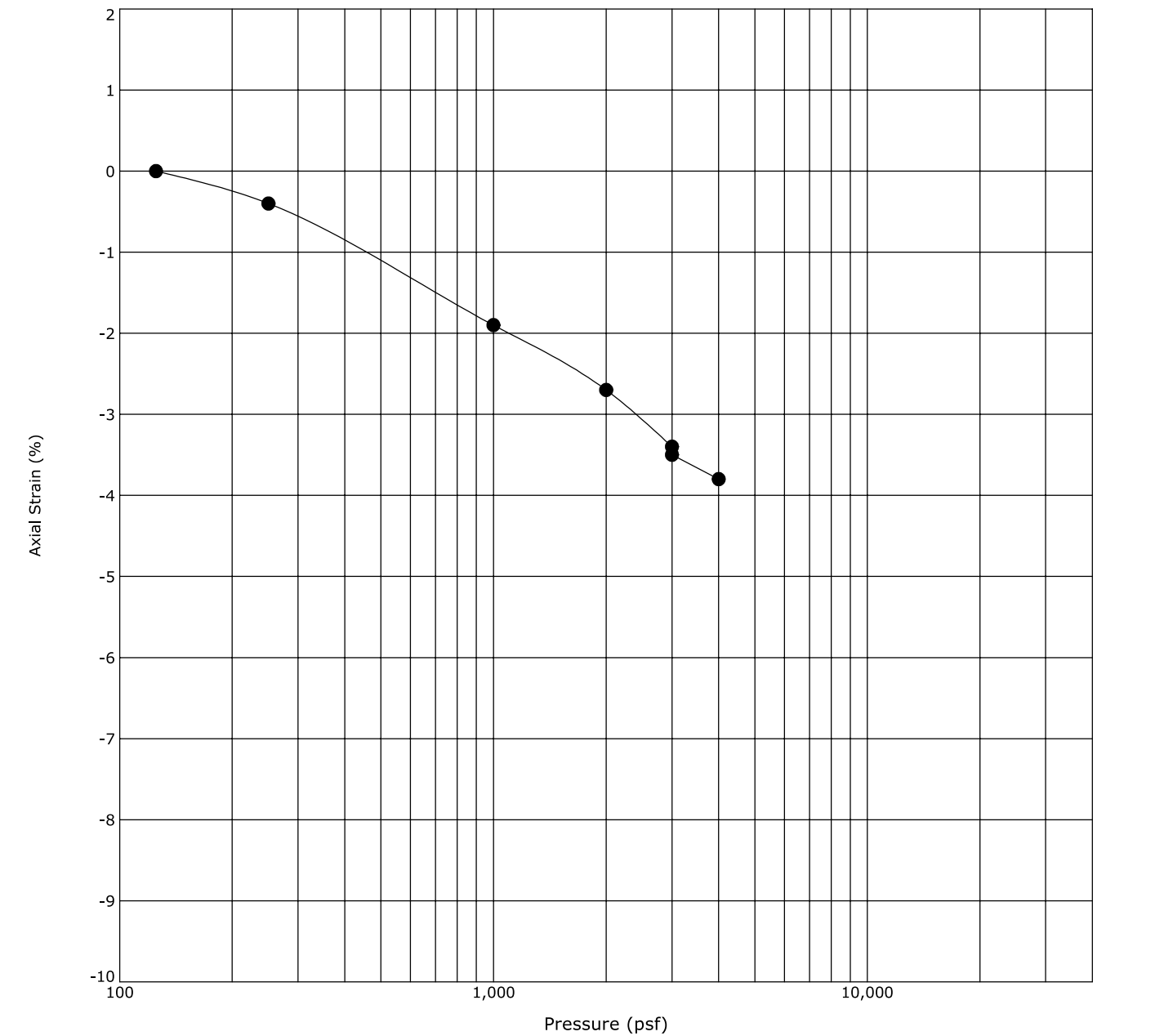
Boring ID		Depth (Ft)		Description of Materials					
P8		1 - 4		SILTY, CLAYEY SAND with GRAVEL					
						● Uncorrected		● Corrected	
Fines (%)	Fraction >4.75 mm size	LL	PL	PI	Test Method	Max DD (pcf)	Optimum WC (%)	Max DD (pcf)	Optimum WC (%)
20	18.3	18	13	5	ASTM D698-Method A	130.2	9.2	135.5	7.6

One-Dimensional Swell or Collapse



Boring ID		Depth (Ft)	Description	USCS	γ _d (pcf)	WC (%)
●	MB1	5 - 6	SILTY SAND with GRAVEL	SM	128	1.0
Notes: Sample submerged at 3000 psf						

One-Dimensional Swell or Collapse



Boring ID		Depth (Ft)	Description	USCS	γ _d (pcf)	WC (%)
●	MB1	10 - 11	SILTY SAND	SM	131	8.3
Notes: Sample submerged at 3000 psf						

ASTM D2844 R-VALUE AND EXP. PRESSURE OF SOILS

Report Number: 63245064.0032
Service Date: 10/01/25
Report Date: 10/03/25
Task:



4685 S Ash Ave, Ste H-4
Tempe, AZ 85282-6767
480-897-8200

Client

HDR Engineering, Inc.
Attn: Ted Buell
1 S Church Ave
Tucson, AZ 85701

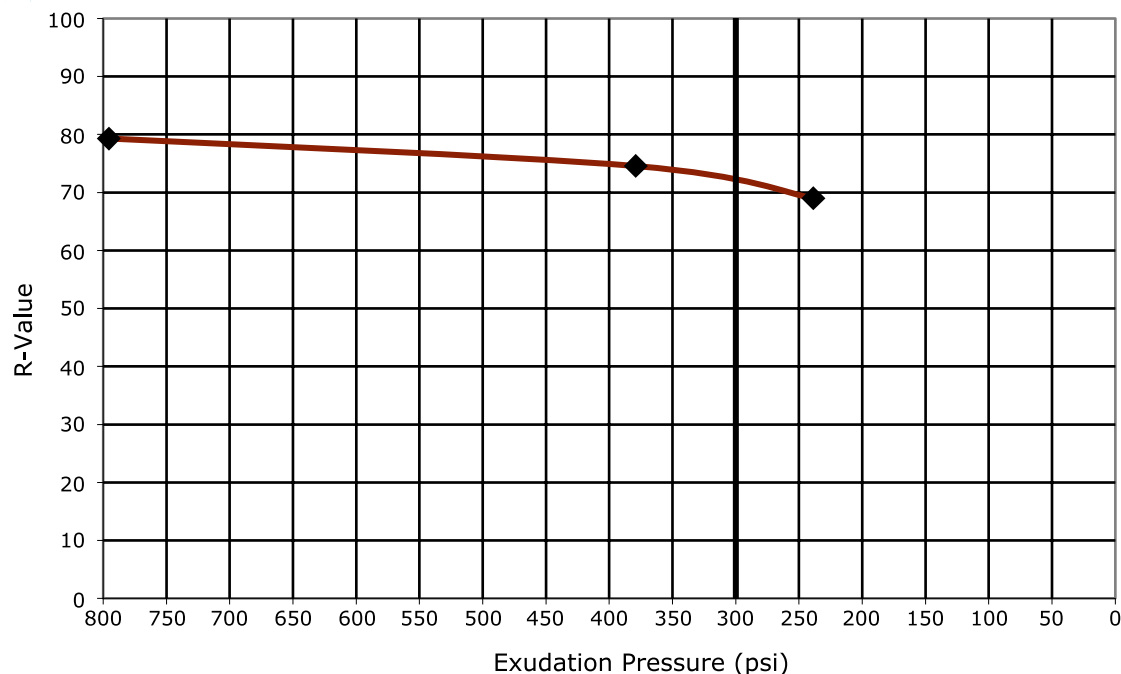
Project

Madera Canyon Bridge Project
Madera Canyon Road
Pima County, AZ 85629

Project No. 63245064

Material Description:	Silty Sand w/ Gravel	Sample Source:	Madera Canyon
Sample Location:	P3 @ 1'-4'		

Specimen ID:	A	B	C
Moisture Content (%):	8.2%	7.7%	7.3%
Compaction Pressure (psi):	350	350	350
Specimen Height (in):	2.51	2.52	2.53
Dry Density (pcf):	133.6	133.6	134.6
Horizontal Pressure @ 1000 lbs (psi):	20	18	16
Horizontal Pressure @ 2000 lbs (psi):	30	27	23
Displacement (turns):	4.87	4.2	3.89
Expansion Pressure (psi):	0	0	0
Exudation Pressure (psi):	239	379	796
R-Value:	69.0	74.6	79.3



**R-Value at
300 psi:**

72

Remarks:

**Sample C - 4 Lights
@ 10000 lbf.**

Services:

Terracon Rep:

Reported To:

Contractor:

Report Distribution

(1) HDR Engineering, Inc., Ted Buell

Louis Braun
Geotechnical Group Manager

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

ASTM D2844 R-VALUE AND EXP. PRESSURE OF SOILS

Report Number: 63245064.0036
Service Date: 10/01/25
Report Date: 10/03/25
Task:



4685 S Ash Ave, Ste H-4
Tempe, AZ 85282-6767
480-897-8200

Client

HDR Engineering, Inc.
Attn: Ted Buell
1 S Church Ave
Tucson, AZ 85701

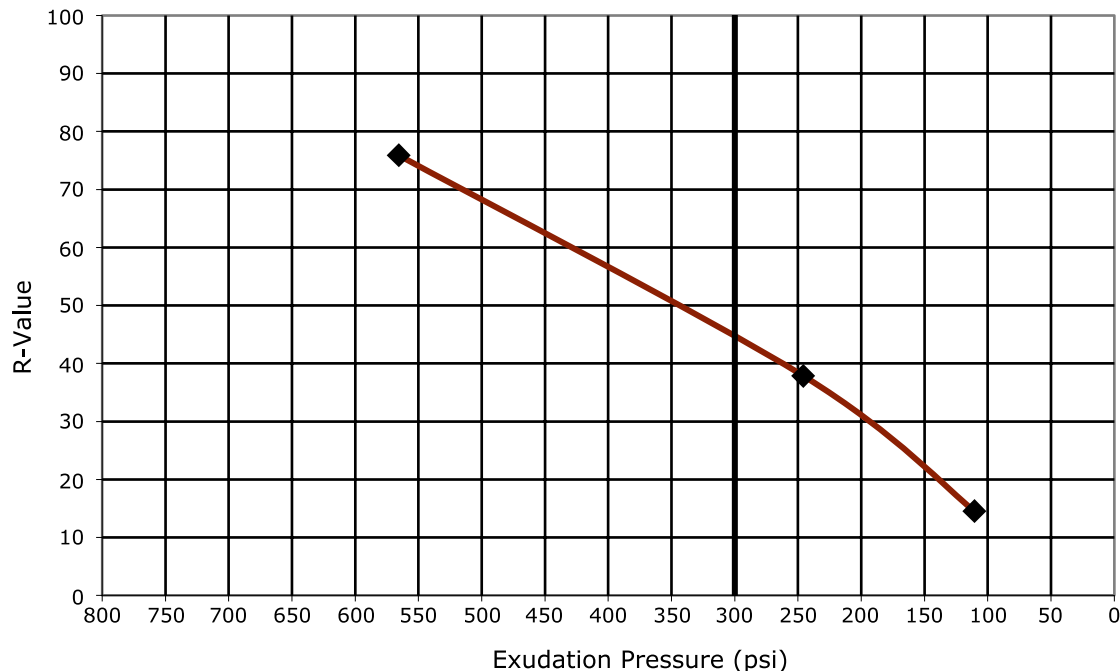
Project

Madera Canyon Bridge Project
Madera Canyon Road
Pima County, AZ 85629

Project No. 63245064

Material Description:	Clayey Sand w/ Gravel	Sample Source:	Madera Canyon
Sample Location:	P7 @ 1'-4'		

Specimen ID:	A	B	C
Moisture Content (%):	11.1%	9.4%	8.5%
Compaction Pressure (psi):	75	150	275
Specimen Height (in):	2.39	2.41	2.51
Dry Density (pcf):	128.2	135.3	132.2
Horizontal Pressure @ 1000 lbs (psi):	58	37	18
Horizontal Pressure @ 2000 lbs (psi):	119	75	26
Displacement (turns):	4.51	4.25	4.09
Expansion Pressure (psi):	0	0	0
Exudation Pressure (psi):	111	246	566
R-Value:	14.6	37.8	75.9



**R-Value at
300 psi:**

45

Remarks:

Services:

Terracon Rep:

Reported To:

Contractor:

Report Distribution

(1) HDR Engineering, Inc., Ted Buell

Louis Braun
Geotechnical Group Manager

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS ASTM D3080



PROJECT:	Madera Canyon Bridge Project	JOB NO:	63245064
LOCATION:	Pima County, AZ	WORK ORDER NO:	63245064.0041
MATERIAL:	Clayey Sand with Gravel	LAB NO:	MB1@20'
SAMPLE SOURCE:	MB1@20'	DATE SAMPLED:	09/26/25

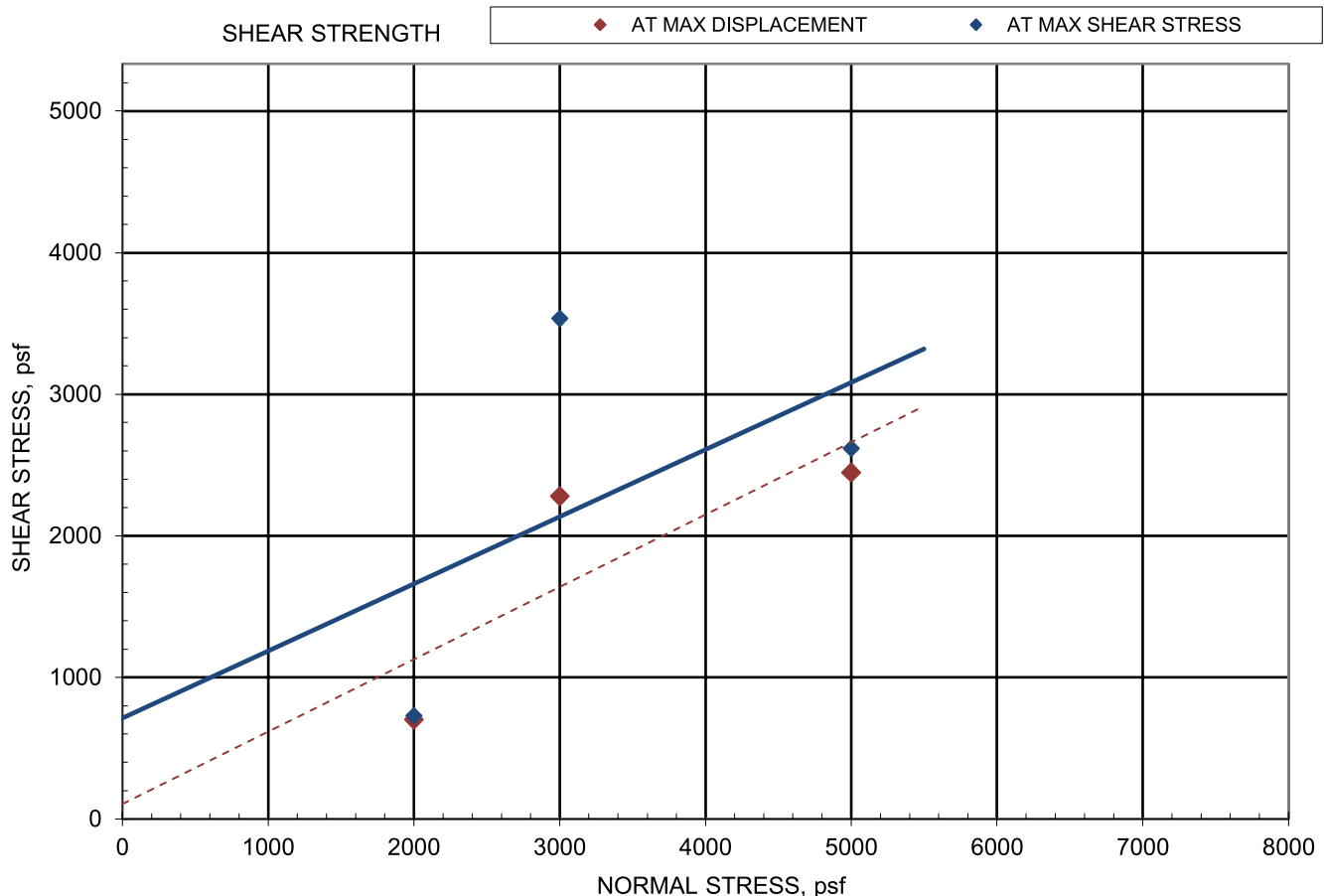
Sample Preparation: Insitu material, moisture and density. Specimens Consolidated @ Normal Load 30 minutes prior to shear. Specimen Inundated.

Initial Parameters of specimen:				Pre- Shear Parameters of specimen:			
	Point 1	Point 2	Point 3		Point 1	Point 2	Point 3
Normal Stress (psf):	2000	3000	5000	Normal Stress (psf):	2000	3000	5000
Dry mass (g):	138.32	137.27	113.41	Dry mass (g):	138.32	137.27	113.41
Height (in):	1.0000	1.0000	1.0000	Height (in):	0.9872	0.918	0.8303
Diameter (in):	2.42	2.42	2.42	Diameter (in):	2.42	2.42	2.42
Moisture, %:	10.9	11.6	12.2	Moisture, %:	47.1	35.8	26.5
Dry Density (pcf):	114.6	113.7	93.9	Dry Density (pcf):	116.1	123.9	113.1
Saturation, %:	65	68	42	Saturation, %:	293	282	152
Void Ratio:	0.44	0.46	0.76	Void Ratio:	0.43	0.34	0.46

Normal Stress (psf):	2000	3000	5000
Maximum Shear Stress, (psf):	728	3534	2617
Displacement at Maximum Shear, (in):	0.318	0.054	0.138
Shear Stress at Max Displacement, (psf)	700	2281	2447
Maximum Displacement, (in):	0.451	0.451	0.451
Rate of Deformation, in/min	0.003	0.003	0.003

SHEAR DEVICE: Humboldt model HM-5760, Pneumatic load force
SPECIFIC GRAVITY: Specific gravity assumed: 2.651

	FRICTION	
	ANGLE	COHESION
AT MAX SHEAR STRESS	25	712
Specs:		
AT MAX DISPLACEMENT	27	106
Specs:		



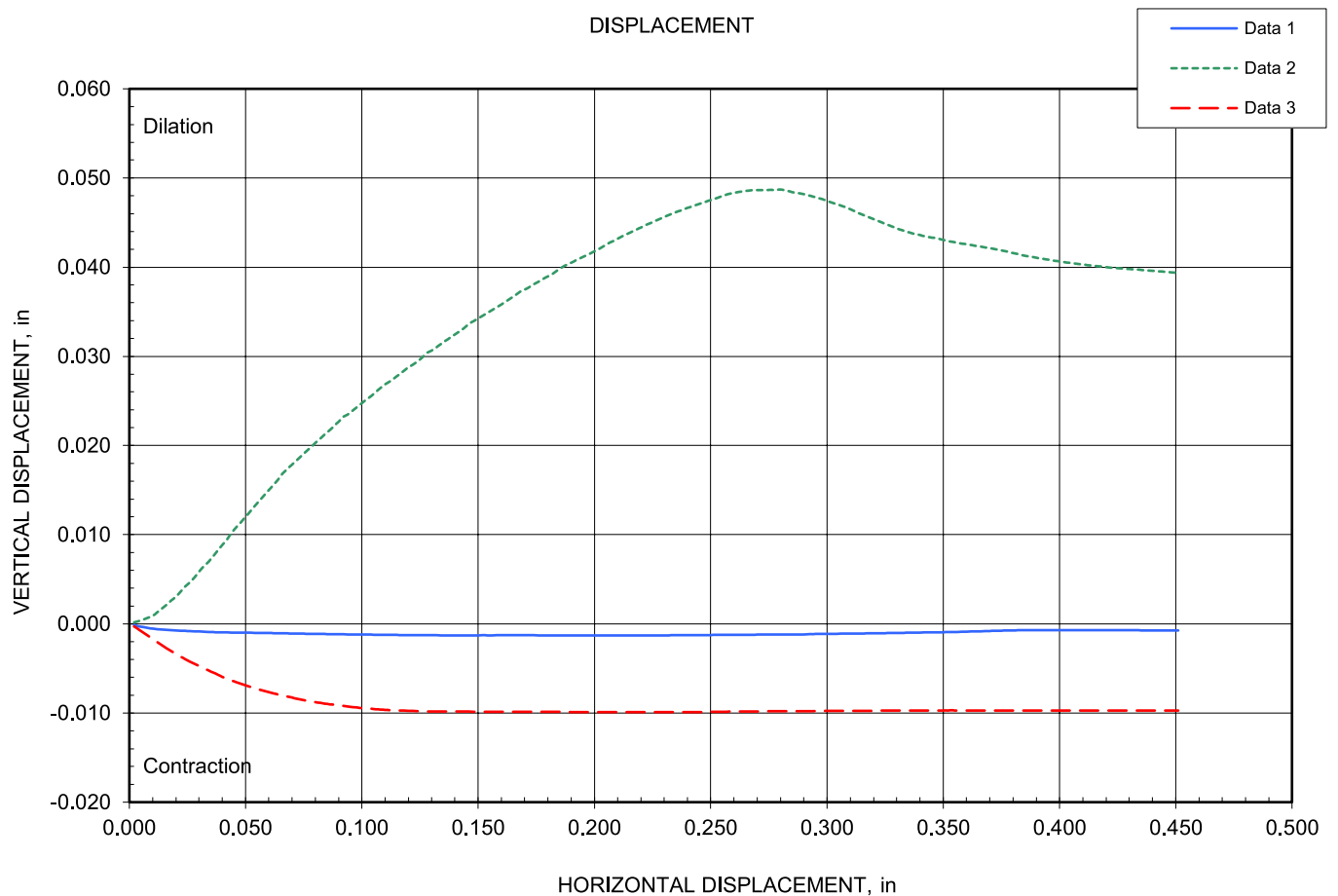
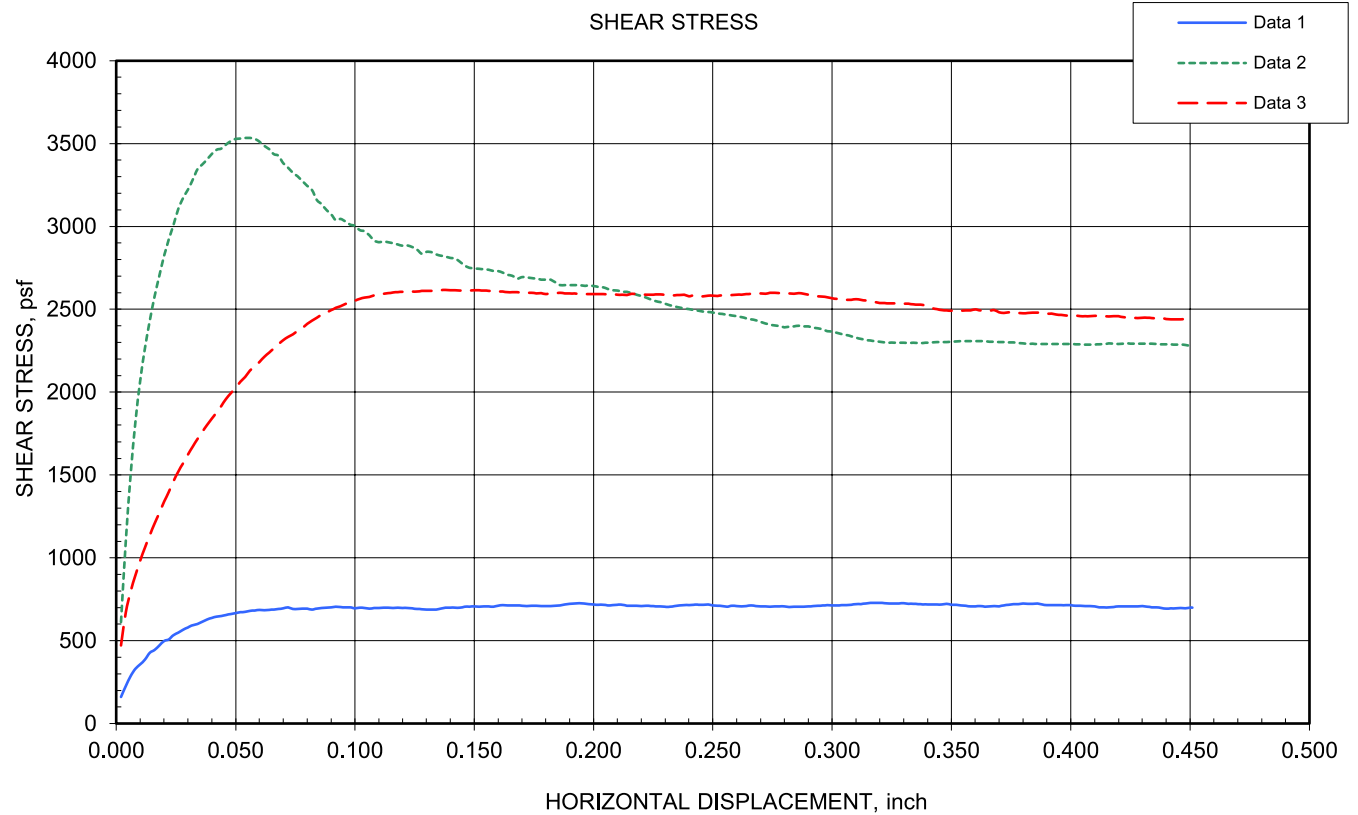
Note: The friction angle presented is applicable only to the load ranges and sample conditions tested. Friction angle and cohesion values are based on the trend line shown in the above plot and may or may not be representative of actual soil conditions. Therefore, adequate engineering judgment should be implemented if

**DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED
DRAINED CONDITIONS ASTM D3080**



PROJECT: Madera Canyon Bridge Project
LOCATION: Pima County, AZ
MATERIAL: Clayey Sand with Gravel
SAMPLE SOURCE: MB1@20'

JOB NO: 63245064
WORK ORDER NO: 63245064.0041
LAB NO: MB1@20'
DATE SAMPLED: 9/26/25



DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS ASTM D3080



PROJECT:	Madera Canyon Bridge Project	JOB NO:	63245064
LOCATION:	Pima County, AZ	WORK ORDER NO:	63245064.0045
MATERIAL:	Silty Clayey Sand with Gravel	LAB NO:	MB2@7.5'
SAMPLE SOURCE:	MB2@7.5'	DATE SAMPLED:	09/29/25

Sample Preparation: Insitu material, moisture and density. Specimens Consolidated @ Normal Load 30 minutes prior to shear. Specimen Inundated.

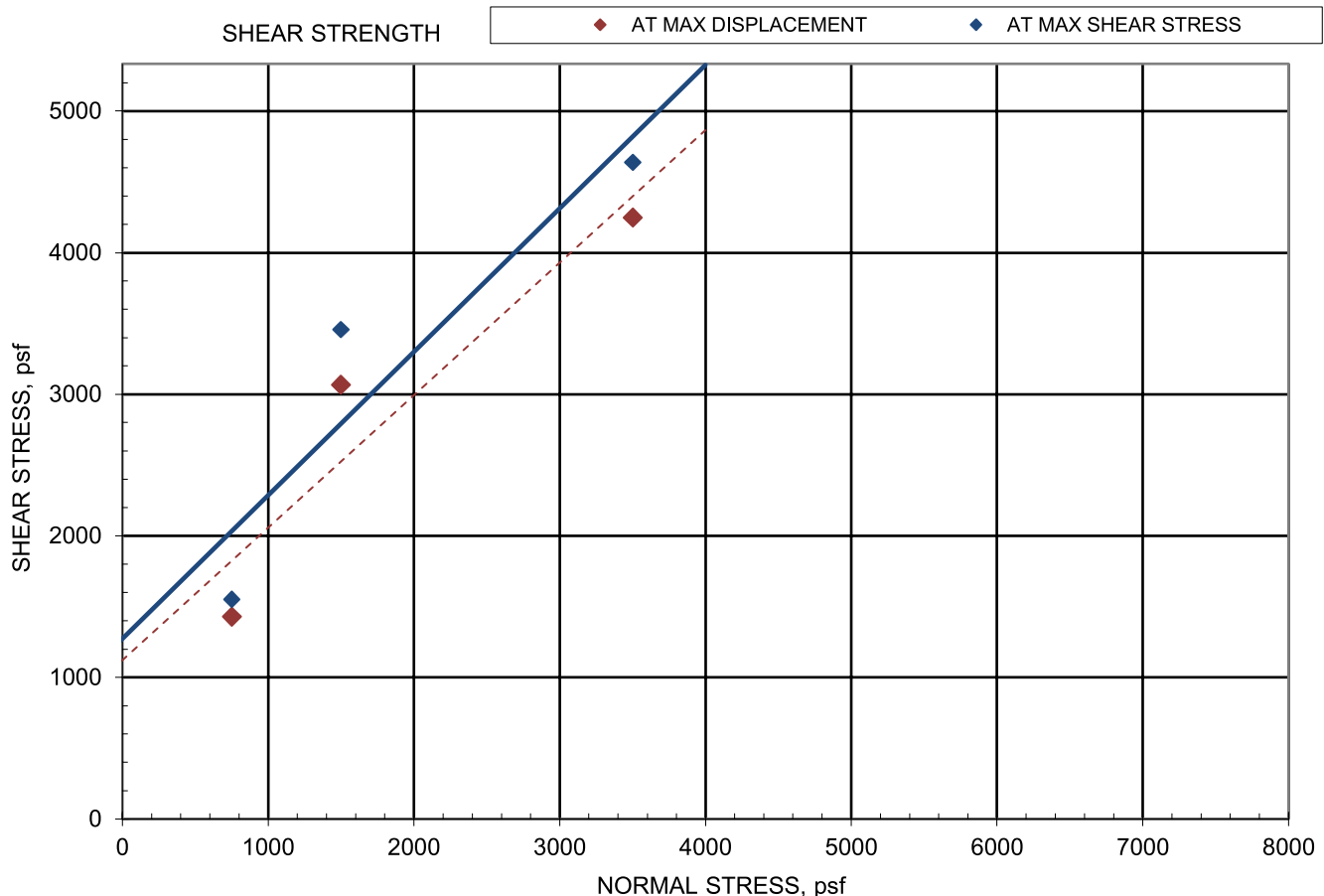
Initial Parameters of specimen:				Pre- Shear Parameters of specimen:			
	Point 1	Point 2	Point 3		Point 1	Point 2	Point 3
Normal Stress (psf):	750	1500	3500	Normal Stress (psf):	750	1500	3500
Dry mass (g):	132.07	132.92	132.92	Dry mass (g):	132.07	132.92	132.92
Height (in):	1.0000	1.0000	1.0000	Height (in):	0.9255	0.8813	0.8085
Diameter (in):	2.42	2.42	2.42	Diameter (in):	2.42	2.42	2.42
Moisture, %:	5.9	6.2	5.1	Moisture, %:	15.4	14.4	15.4
Dry Density (pcf):	109.4	110.1	110.1	Dry Density (pcf):	118.2	124.9	136.2
Saturation, %:	30	33	27	Saturation, %:	102	118	190
Void Ratio:	0.51	0.50	0.50	Void Ratio:	0.40	0.32	0.22

Normal Stress (psf):	750	1500	3500
Maximum Shear Stress, (psf):	1552	3456	4639
Displacement at Maximum Shear, (in):	0.426	0.432	0.280
Shear Stress at Max Displacement, (psf)	1430	3066	4250
Maximum Displacement, (in):	0.451	0.451	0.451
Rate of Deformation, in/min	0.007	0.007	0.007

SHEAR DEVICE: Humboldt model HM-5760, Pneumatic load force

SPECIFIC GRAVITY: Specific gravity assumed: 2.651

	FRICTION	
	ANGLE	COHESION
AT MAX SHEAR STRESS	45	1274
Specs:		
AT MAX DISPLACEMENT	43	1121
Specs:		



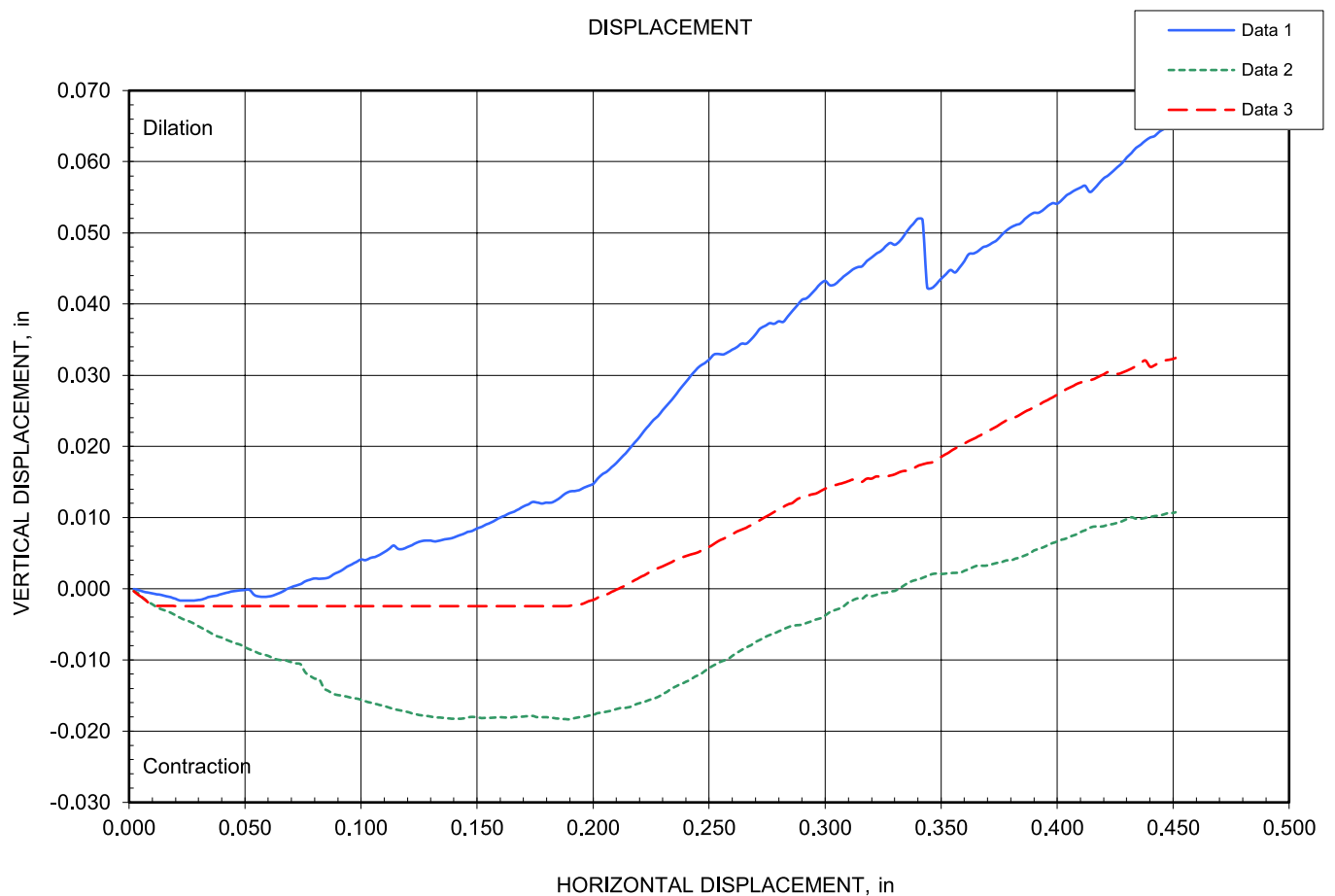
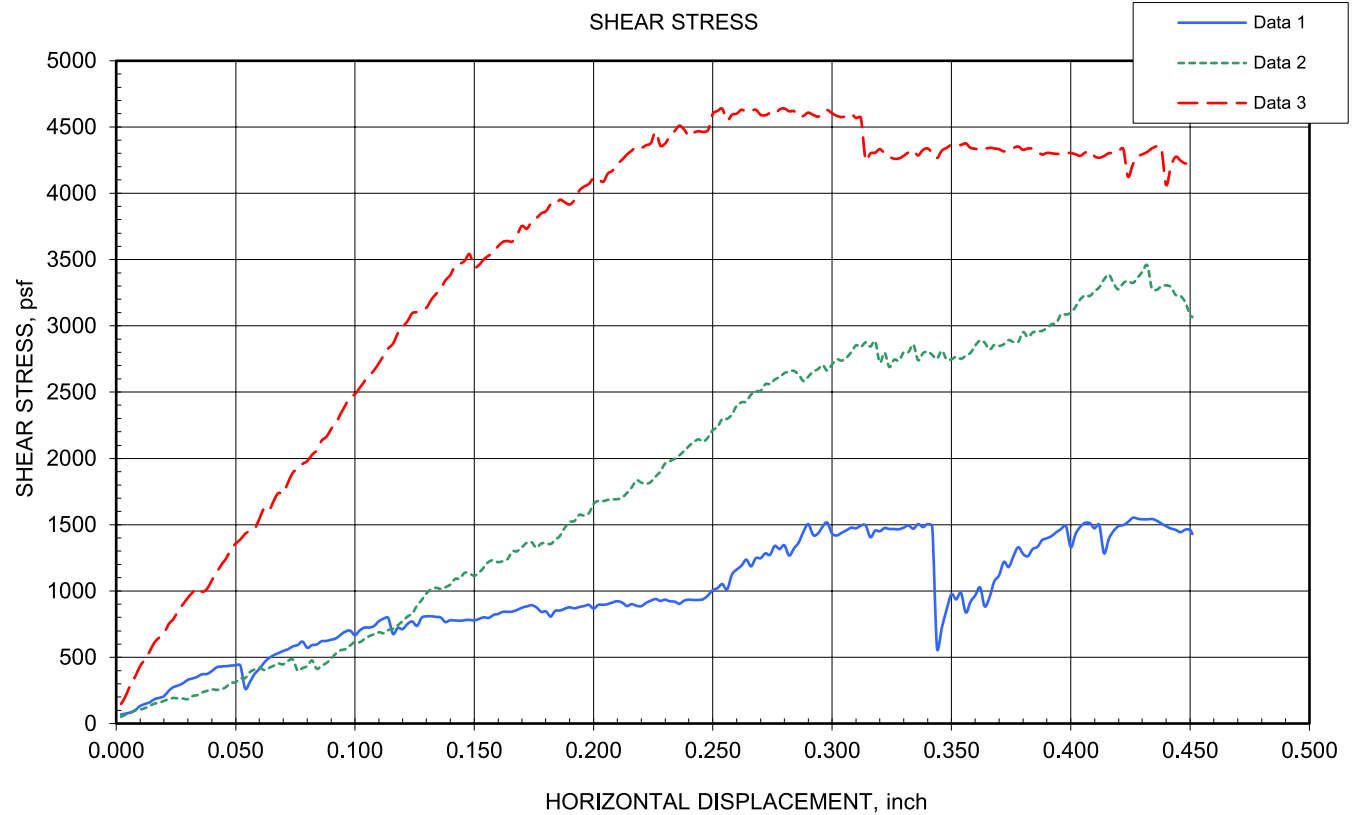
Note: The friction angle presented is applicable only to the load ranges and sample conditions tested. Friction angle and cohesion values are based on the trend line shown in the above plot and may or may not be representative of actual soil conditions. Therefore, adequate engineering judgment should be implemented if

**DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED
DRAINED CONDITIONS ASTM D3080**



PROJECT: Madera Canyon Bridge Project
LOCATION: Pima County, AZ
MATERIAL: Silty Clayey Sand with Gravel
SAMPLE SOURCE: MB2@7.5'

JOB NO: 63245064
WORK ORDER NO: 63245064.0045
LAB NO: MB2@7.5'
DATE SAMPLED: 9/29/25



DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS ASTM D3080



PROJECT:	Madera Canyon Bridge Project	JOB NO:	63245064
LOCATION:	Pima County, AZ	WORK ORDER NO:	63245064.0043
MATERIAL:	Sandy Lean Clay	LAB NO:	MB2@17.5'
SAMPLE SOURCE:	MB2@17.5'	DATE SAMPLED:	09/26/25

Sample Preparation: Insitu material, moisture and density. Specimens Consolidated @ Normal Load 30 minutes prior to shear. Specimen not Inundated.

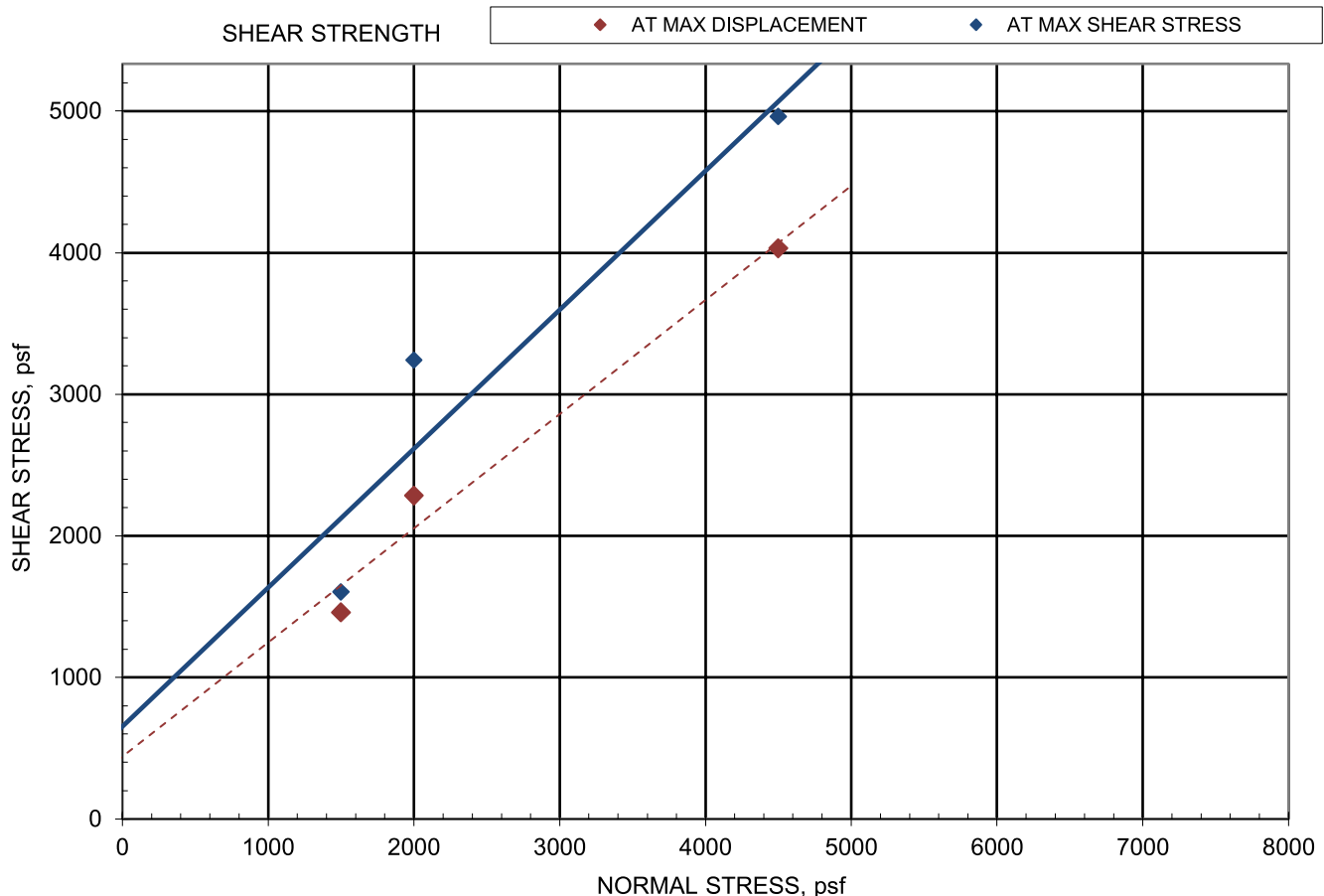
Initial Parameters of specimen:				Pre- Shear Parameters of specimen:			
	Point 1	Point 2	Point 3		Point 1	Point 2	Point 3
Normal Stress (psf):	1500	2000	4500	Normal Stress (psf):	1500	2000	4500
Dry mass (g):	122.56	125.30	122.70	Dry mass (g):	122.56	125.30	122.70
Height (in):	1.0000	1.0000	1.0000	Height (in):	0.9806	0.9754	0.9434
Diameter (in):	2.42	2.42	2.42	Diameter (in):	2.42	2.42	2.42
Moisture, %:	7.7	6.5	6.2	Moisture, %:	6.4	4.2	5.2
Dry Density (pcf):	101.5	103.8	101.6	Dry Density (pcf):	103.5	106.4	107.7
Saturation, %:	32	29	26	Saturation, %:	28	20	26
Void Ratio:	0.63	0.59	0.63	Void Ratio:	0.60	0.56	0.54

Normal Stress (psf):	1500	2000	4500
Maximum Shear Stress, (psf):	1603	3241	4963
Displacement at Maximum Shear, (in):	0.117	0.214	0.274
Shear Stress at Max Displacement, (psf)	1459	2284	4030
Maximum Displacement, (in):	0.451	0.451	0.451
Rate of Deformation, in/min	0.003	0.003	0.003

SHEAR DEVICE: Geomatic model 8914, Dead Weight load force

SPECIFIC GRAVITY: Specific gravity assumed: 2.651

	FRICTION	
	ANGLE	COHESION
AT MAX SHEAR STRESS	44	653
Specs:		
AT MAX DISPLACEMENT	39	442
Specs:		



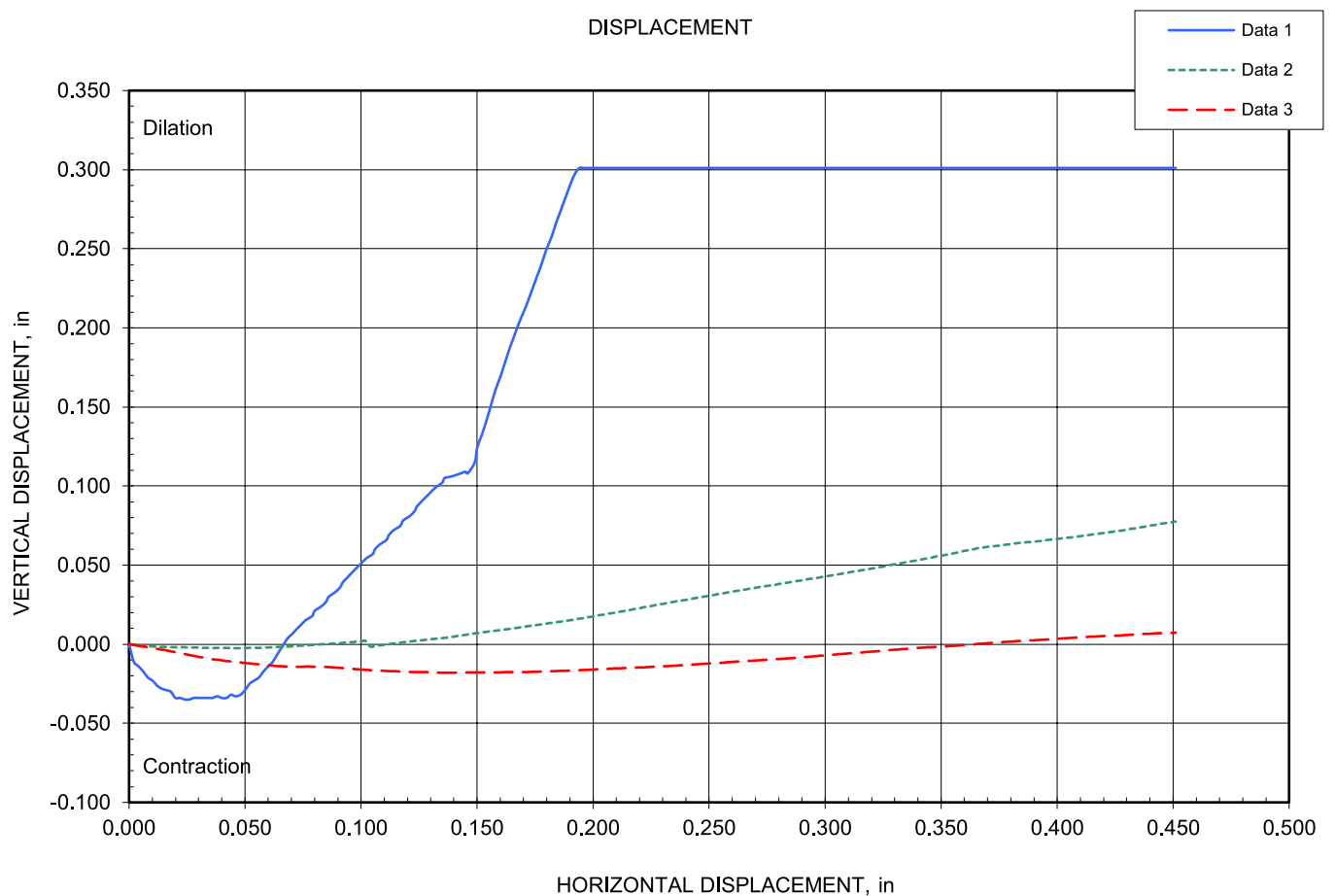
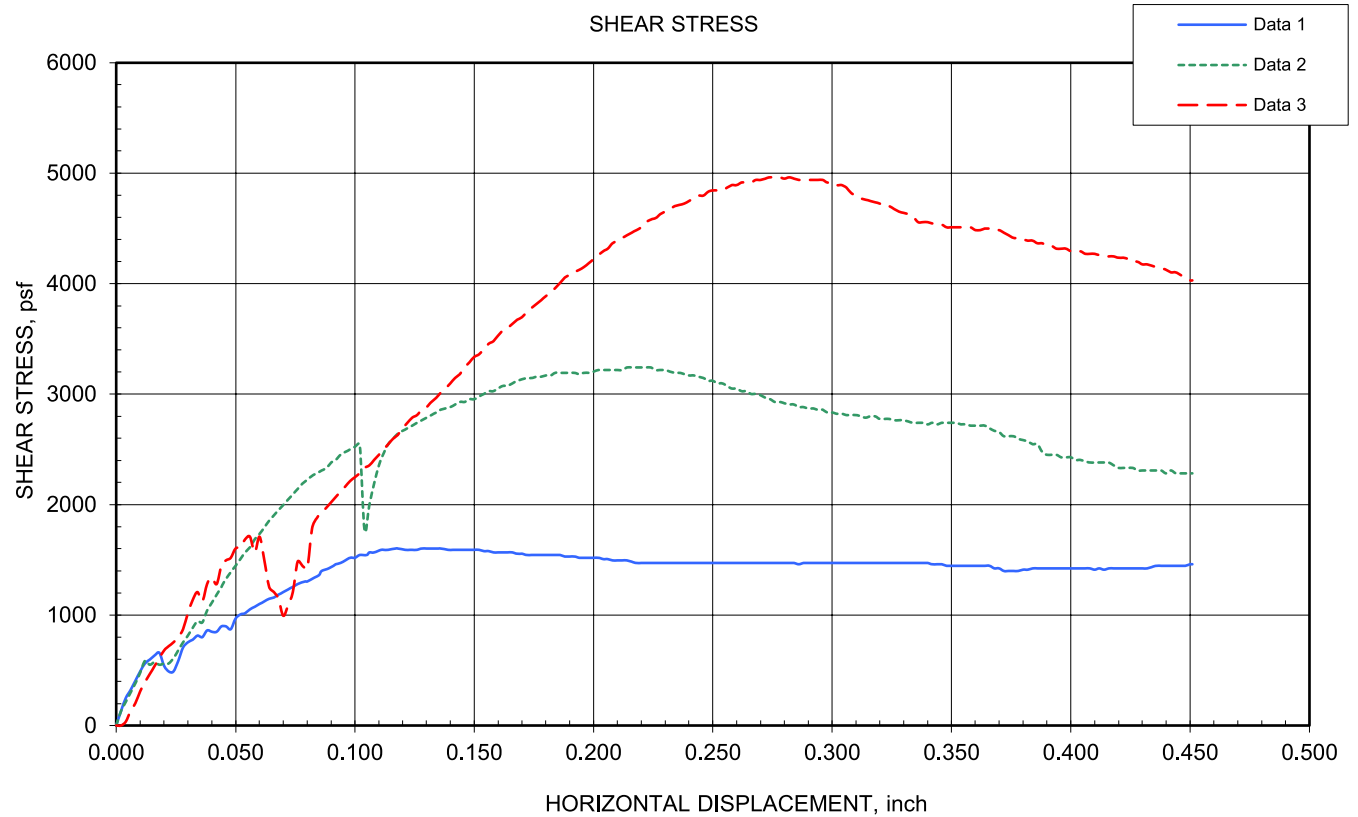
Note: The friction angle presented is applicable only to the load ranges and sample conditions tested. Friction angle and cohesion values are based on the trend line shown in the above plot and may or may not be representative of actual soil conditions. Therefore, adequate engineering judgment should be implemented if

**DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED
DRAINED CONDITIONS ASTM D3080**



PROJECT: Madera Canyon Bridge Project
LOCATION: Pima County, AZ
MATERIAL: Sandy Lean Clay
SAMPLE SOURCE: MB2@17.5'

JOB NO: 63245064
WORK ORDER NO: 63245064.0043
LAB NO: MB2@17.5'
DATE SAMPLED: 9/26/25



**Client**

HDR Engineering, Inc

Project

Madera Canyon Bridge Project

63245064

Date Received: 10/6/2025**Corrosivity Suite - Results**

Sample Location		FB1	FB1	FB2	FB2
Sample Depth (ft.)		1.0-2.5	6.0-7.5	0.0-1.5	3.0-5.0
Acidity (pH)	ASTM G51	7.08	7.59	7.03	7.69
Water Soluble Sulfate Ion Content (mg/Kg)	ASTM C1580	61	9	102	25
Water Soluble Sulfide Content (mg/Kg)	AWWA 4500-S,D	Nil	Nil	Nil	Nil
Water Soluble Chloride Ion Content (mg/Kg)	AASHTO T291A	14	10	21	21
Oxidation-Reduction Potential (RmV)	ASTM G200	277	272	317	294
Total Dissolved Salts (mg/Kg)	AWWA 2520 B	410	150	85	70
Electrical Resistivity (Ω -cm)	ASTM G57	2700	5500	7600	14000

Verified By: Nathan Campo
10/9/2025

These tests were performed in general accordance with the applicable AASHTO, ASTM, and AWWA test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced without the full written consent of Terracon Consultants Inc.. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar materials.

**Client**

HDR Engineering, Inc

Project

Madera Canyon Bridge Project

63245064

Date Received: 10/6/2025**Corrosivity Suite - Results**

Sample Location		MB1	MB1	MB2	MB2
Sample Depth (ft.)		0.0-2.5	5.0-7.5	2.5-5.0	5.0-7.5
Acidity (pH)	ASTM G51	7.86	6.29	8.03	7.83
Water Soluble Sulfate Ion Content (mg/Kg)	ASTM C1580	19	72	15	17
Water Soluble Sulfide Content (mg/Kg)	AWWA 4500-S,D	Nil	Nil	Nil	Nil
Water Soluble Chloride Ion Content (mg/Kg)	ASTM D512	28	30	14	18
Oxidation-Reduction Potential (RmV)	ASTM G200	243	354	246	260
Total Dissolved Salts (mg/Kg)	AWWA 2520 B	90	115	85	120
Electrical Resistivity (Ω ·cm)	ASTM G57	27000	8000	24000	15000

Verified By: Nathan Campo
10/9/2025

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SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing						Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI ₅₀	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)		
FB1	1.0 - 2.5	SC			23	28	17	11							7.1	2700	61	14	
FB1	2.5 - 4.0	SC			30	29	18	11											
FB1	2.5 - 4.0	SC		5															2
FB1	5.0 - 5.5	GW			4														
FB1	6.0 - 7.5	SC-SM			37	26	21	5							7.6	5500	9	10	
FB1	8.5 - 10.0	SC			36	24	16	8											
FB1	15.0 - 17.5	SM			22	26	23	3											
FB1	20.0 - 23.0	SM			32	22	19	3											
FB1	25.0 - 25.5	SC		4															2
FB1	30.0 - 31.0	SC		4															2
FB1	45.0 - 46.5	SC		9															2
FB1	55.0 - 56.5	SC		8															2
FB2	0.0 - 1.5	SC			26	27	19	8							7.0	7600	102	21	
FB2	3.0 - 8.0	SM			28	NP	NP	NP							7.7	14000	25	21	
FB2	5.0 - 6.5	SM		4															2
FB2	9.0 - 10.0	SC-SM			32	23	17	6											
FB2	17.5 - 18.5	SC-SM		5															2
FB2	18.0 - 20.0	SC-SM			30	26	20	6											
FB2	30.0 - 31.0	SC-SM		6															2
FB2	31.0 - 34.0	SC-SM			23	25	18	7											
FB2	50.0 - 51.5	SC		8															2
FB2	55.0 - 56.5	SC		10															2
MB1	0.0 - 2.5	GW-GM			8	NP	NP	NP							7.9	27000	19	28	
MB1	2.5 - 5.0	GC-GM			21	24	18	6											
MB1	5.0 - 7.5	GC			28	25	16	9							6.3	8000	72	30	

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: Madera Canyon Bridge Project

PROJECT NUMBER: 63245064

SITE: Madera Canyon Road
Pima County, Arizona



CLIENT: HDR Engineering, Inc.
Tucson, Arizona

PH. 520-770-1789 FAX. 520-792-2539

SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	LL	PL	PI	Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI ₅₀	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
MB1	5.0 - 6.0	SM	128	1	13	NP	NP	NP										
MB1	7.0 - 8.5	SC-SM		13														2
MB1	7.5 - 10.0	SC-SM			37	25	20	5										
MB1	10.0 - 12.5	SC			49	28	16	12										
MB1	10.0 - 11.0	SM	131	8	11	NP	NP	NP										1
MB1	12.0 - 13.5	SC		12														2
MB1	15.0 - 15.5	GP			5													
MB1	20.0 - 25.0	SC-SM			38	25	19	6										
MB1	20.0 - 21.0	CL-MIL			63													
MB1	30.0 - 35.0	SC-SM			48	23	17	6										
MB1	30.0 - 31.0	SC-SM	7															2
MB1	40.0 - 40.5	SC	3															2
MB1	45.0 - 46.0	SC	13															2
MB1	55.0 - 56.5	SC	12															2
MB1	60.0 - 60.5	SC	8															2
MB2	0.0 - 2.5	SW-SM			9	NP	NP	NP										
MB2	2.5 - 5.0	SC-SM			12	24	18	6						8.0	24000	15	14	
MB2	2.5 - 3.5	GP-GM			7	NP	NP	NP										
MB2	5.0 - 7.5	GM			17	NP	NP	NP						7.8	15000	17	18	
MB2	5.0 - 6.5	GM	2															2
MB2	7.5 - 10.0	SC-SM			25	20	16	4										
MB2	7.5 - 8.5	GP-GM			7	NP	NP	NP										
MB2	10.0 - 11.5	SC-SM	2															2
MB2	12.0 - 13.0	SC-SM			34	24	20	4										
MB2	15.0 - 16.5	SC-SM			30	24	19	5										

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: Madera Canyon Bridge Project



355 S Euclid Ave, Ste 107
Tucson, AZ

PROJECT NUMBER: 63245064

CLIENT: HDR Engineering, Inc.
Tucson, Arizona

SITE: Madera Canyon Road
Pima County, Arizona

PH. 520-770-1789 FAX. 520-792-2539

SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	LL	PL	PI	Div Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI ₅₀	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
MB2	17.0 - 18.0	SC			41	31	22	9										
MB2	17.5 - 20.0	CL			53	26	17	9										
MB2	20.0 - 21.5	CL		9	52	25	17	8										
MB2	30.0 - 35.0	SC-SM			44	22	17	5										
MB2	30.0 - 31.5	SC-SM		6														2
MB2	40.0 - 41.5	SC		8														2
MB2	45.0 - 46.0	SC		8														2
MB2	60.0 - 61.5	SC		12														2
MB2	70.0 - 71.0	SC		12														2
MB2	75.0 - 76.0	SC		11														2
P1	1.0 - 4.0	SC			34	26	14	12										
P1	5.0 - 6.0	SC	119	3														1, 2
P2	1.0 - 4.0	SC			39	30	14	16	115	8.6	125	4.3						
P2	2.5 - 3.5	SC	114	6														1, 2
P3	1.0 - 4.0	SM			23	NP	NP	NP										
P4	1.0 - 4.0	SC-SM			37	18	14	4	121	6.6	125	0.6						
P4	2.5 - 3.5	SC-SM	98	3														1, 2
P5	1.0 - 4.0	SC			35	28	14	14										
P5	5.0 - 6.0	SC	114	3														1, 2
P6	1.0 - 4.0	SC-SM			21	20	16	4	122	6.0	125	1.0						
P6	2.5 - 3.5	SC-SM	121	3														1, 2
P7	1.0 - 4.0	SC			26	23	13	10										
P7	5.0 - 6.0	SM	105	4														1, 2
P8	1.0 - 4.0	SC-SM			20	18	13	5	124	6.3	125	1.0						
P8	2.5 - 3.5	SC-SM	120	2														1, 2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: Madera Canyon Bridge Project



PROJECT NUMBER: 63245064

SITE: Madera Canyon Road
Pima County, Arizona

CLIENT: HDR Engineering, Inc.
Tucson, Arizona

PH. 520-770-1789 FAX. 520-792-2539

Supporting Information

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

General Notes

Sampling	Water Level	Field Tests
 Auger Cuttings  Rock Core  Ring Sampler  Standard Penetration Test	 Water Initially Encountered  Water Level After a Specified Period of Time  Water Level After a Specified Period of Time  Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance				Bedrock		
Relative Density	Standard Penetration or N-Value (Blows/Ft.)	Ring Sampler (Blows/Ft.)	Consistency	Unconfined Compressive Strength Qu (psf)	Standard Penetration or N-Value (Blows/Ft.)	Ring Sampler (Blows/Ft.)	Ring Sampler (Blows/Ft.)	Standard Penetration or N-Value (Blows/Ft.)	Consistency
Very Loose	0 - 3	0 - 5	Very Soft	less than 500	0 - 1	< 3	< 30	< 20	Weathered
Loose	4 - 9	6 - 14	Soft	500 to 1,000	2 - 4	3 - 6	30 - 43	20 - 29	Firm
Medium Dense	10 - 29	15 - 44	Medium Stiff	1,000 to 2,000	4 - 8	7 - 12	44 - 73	30 - 49	Medium Hard
Dense	30 - 50	45 - 75	Stiff	2,000 to 4,000	8 - 15	13 - 23	74 - 118	50 - 79	Hard
Very Dense	> 50	> 75	Very Stiff	4,000 to 8,000	15 - 30	24 - 45	> 118	> 79	Very Hard
			Hard	> 8,000	> 30	> 45			

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification	
				Group Symbol	Group Name ^B
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu≥4 and 1≤Cc≤3 ^E	GW	Well-graded gravel ^F
			Cu<4 and/or [Cc<1 or Cc>3.0] ^E	GP	Poorly graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}
			Fines classify as CL or CH	GC	Clayey gravel ^{F, G, H}
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Cu≥6 and 1≤Cc≤3 ^E	SW	Well-graded sand ^I
			Cu<6 and/or [Cc<1 or Cc>3.0] ^E	SP	Poorly graded sand ^I
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}
			Fines classify as CL or CH	SC	Clayey sand ^{G, H, I}
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots above “A” line ^J	CL	Lean clay ^{K, L, M}
			PI < 4 or plots below “A” line ^J	ML	Silt ^{K, L, M}
		Organic:	$\frac{LL\text{ oven dried}}{LL\text{ not dried}} < 0.75$	OL	Organic clay ^{K, L, M, N} Organic silt ^{K, L, M, O}
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above “A” line	CH	Fat clay ^{K, L, M}
			PI plots below “A” line	MH	Elastic silt ^{K, L, M}
		Organic:	$\frac{LL\text{ oven dried}}{LL\text{ not dried}} < 0.75$	OH	Organic clay ^{K, L, M, P} Organic silt ^{K, L, M, Q}
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

- ^A Based on the material passing the 3-inch (75-mm) sieve.

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

^E $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

^F If soil contains ≥ 15% sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
- ^H If fines are organic, add "with organic fines" to group name.

^I If soil contains ≥ 15% gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

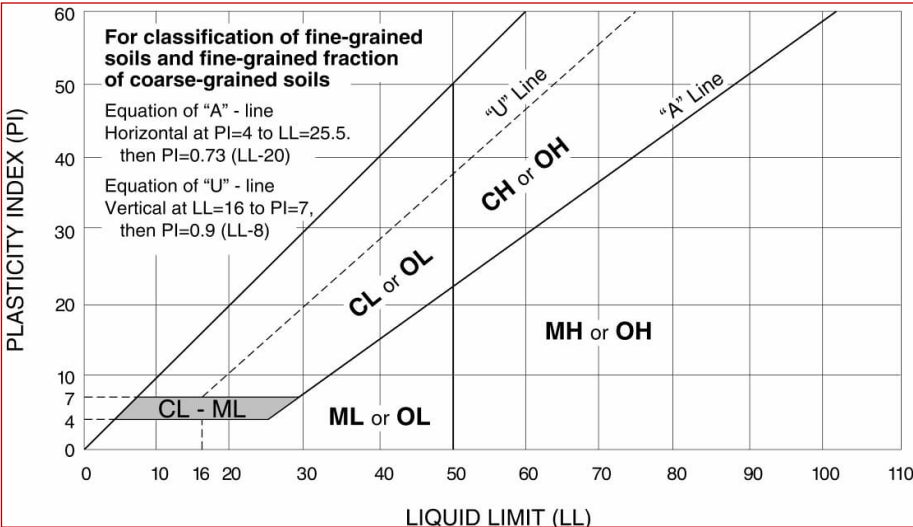
^M If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

^N PI ≥ 4 and plots on or above "A" line.

^O PI < 4 or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



APPENDIX C

Spread Footing Design Charts C-1a to C-5b



Madera Canyon Road
Florida Canyon Wash Bridge Replacement

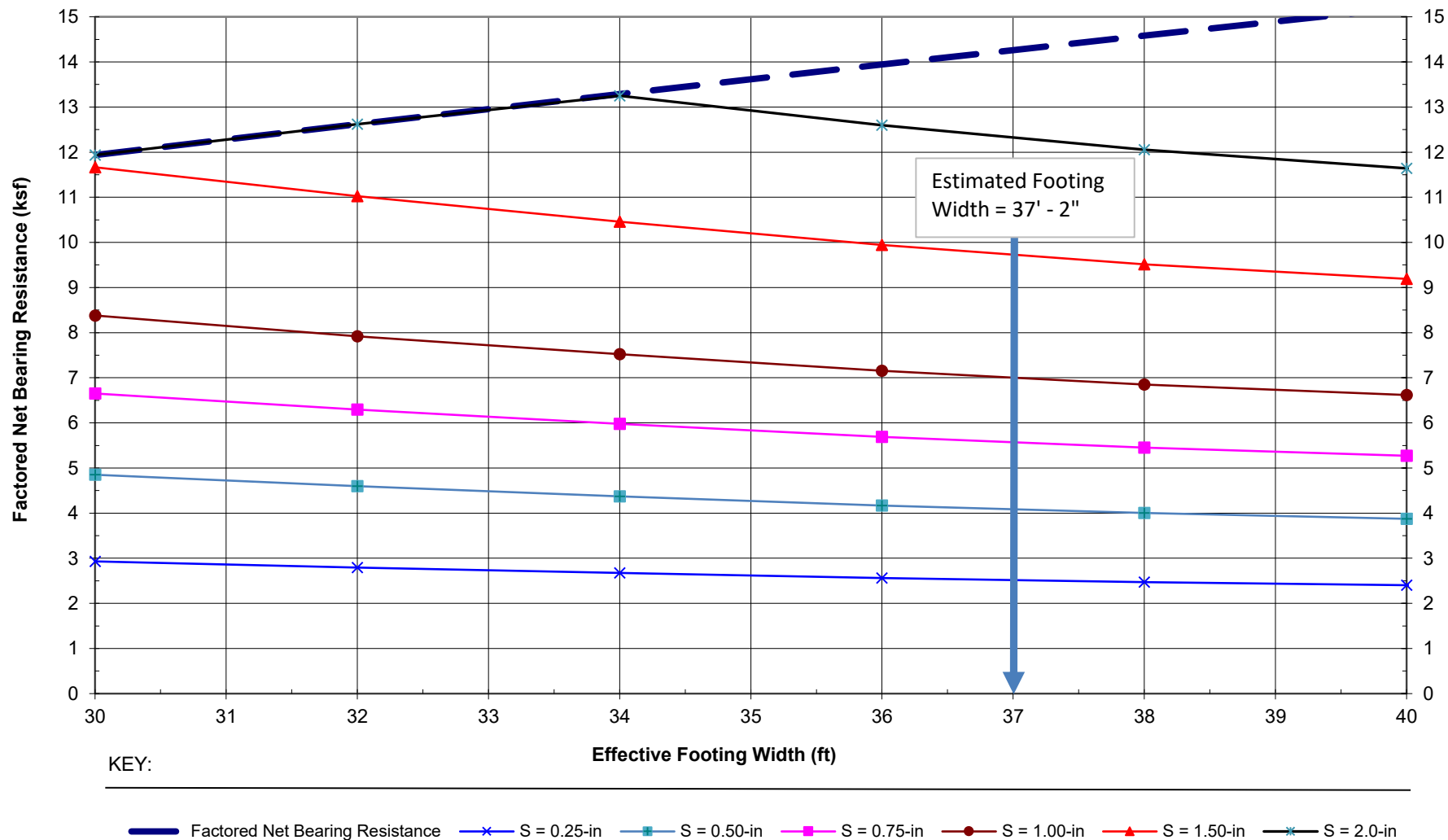


Figure C-1a: Bearing Resistance Chart, Box Culvert Bridge, Florida Canyon Wash Bridge Replacement
Effective Footing Length = 102 ft; Bearing Elevation at 3658 feet or lower. Depth of embedment $D_f = 5$ ft.
S = Immediate Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
C-1a



Madera Canyon Road
Florida Canyon Wash Bridge Replacement

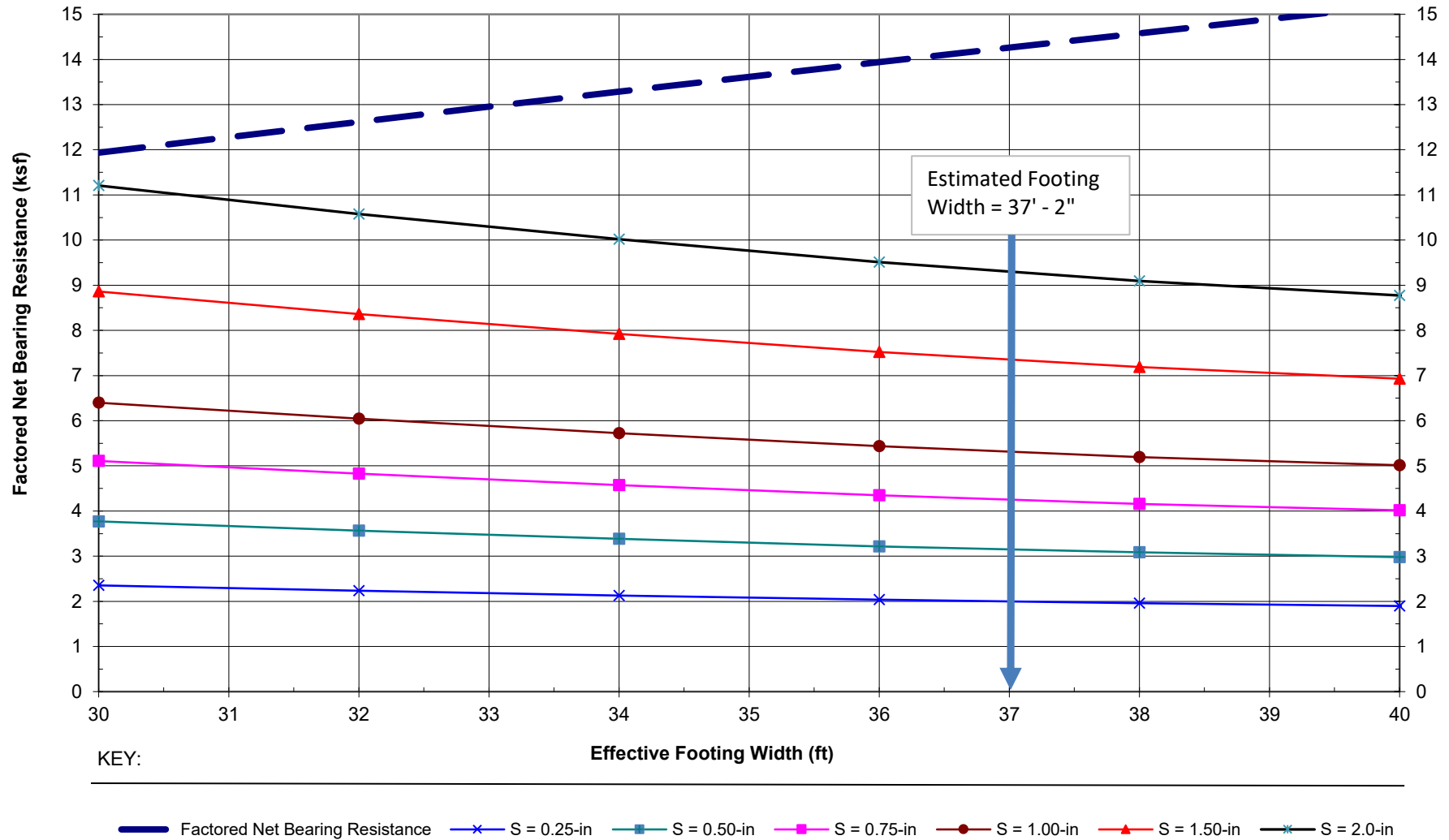


Figure C-1b: Bearing Resistance Chart, Box Culvert Bridge, Florida Canyon Wash Bridge Replacement
Effective Footing Length = 102 ft; Bearing Elevation at 3658 feet or lower. Depth of embedment $D_f = 5$ ft.
 S = Total (Immediate plus long-term) Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
C-1b

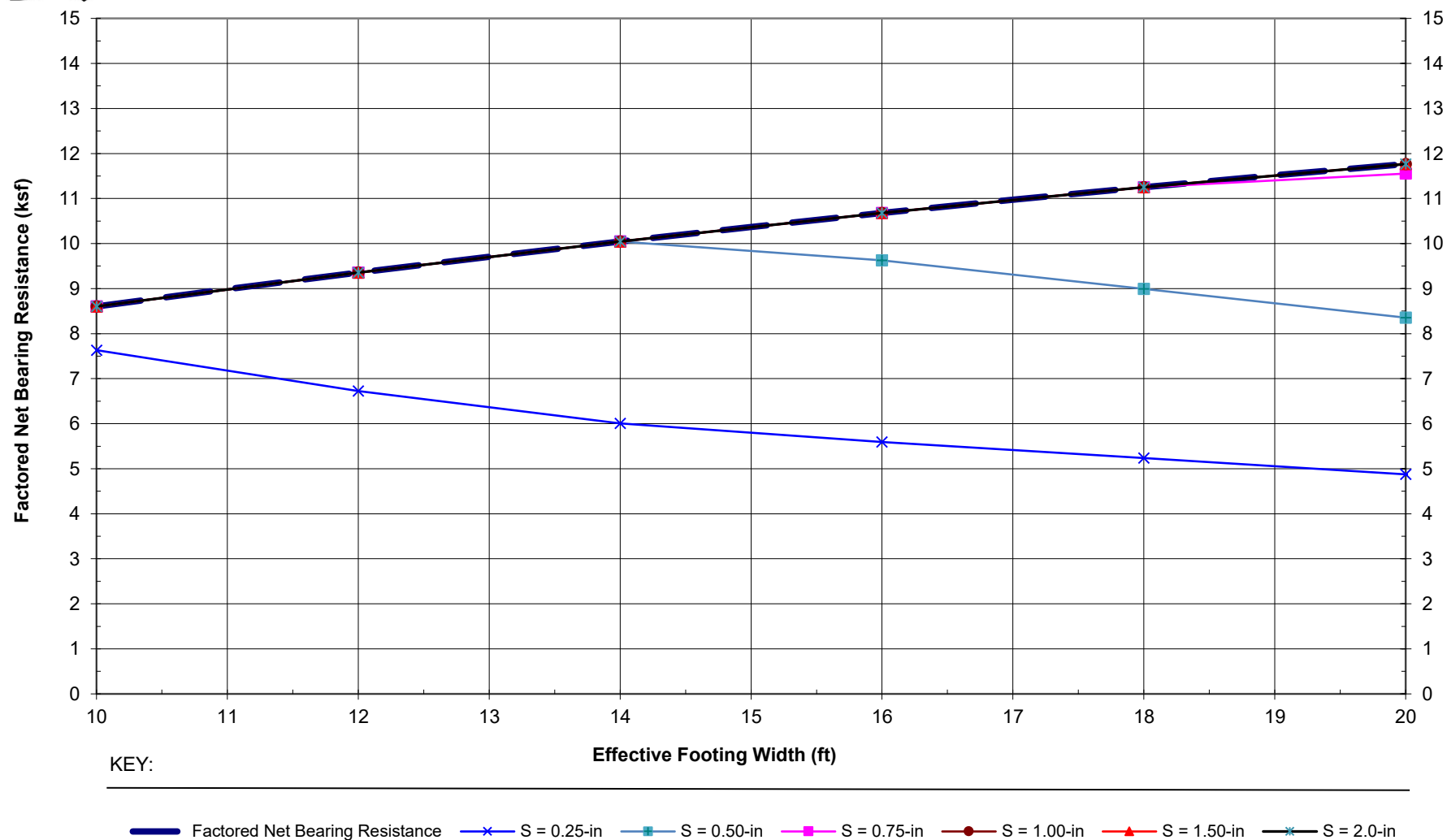


Figure C-2a: Bearing Resistance Chart, Abutment 1 Wing Wall 1, Florida Canyon Wash Bridge Replacement
Effective Footing Length = 24.5 ft; Bearing Elevation at 3658 feet or lower. Depth of embedment Df = 5 ft.
S = Immediate Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
C-2a



Madera Canyon Road
Florida Canyon Wash Bridge Replacement

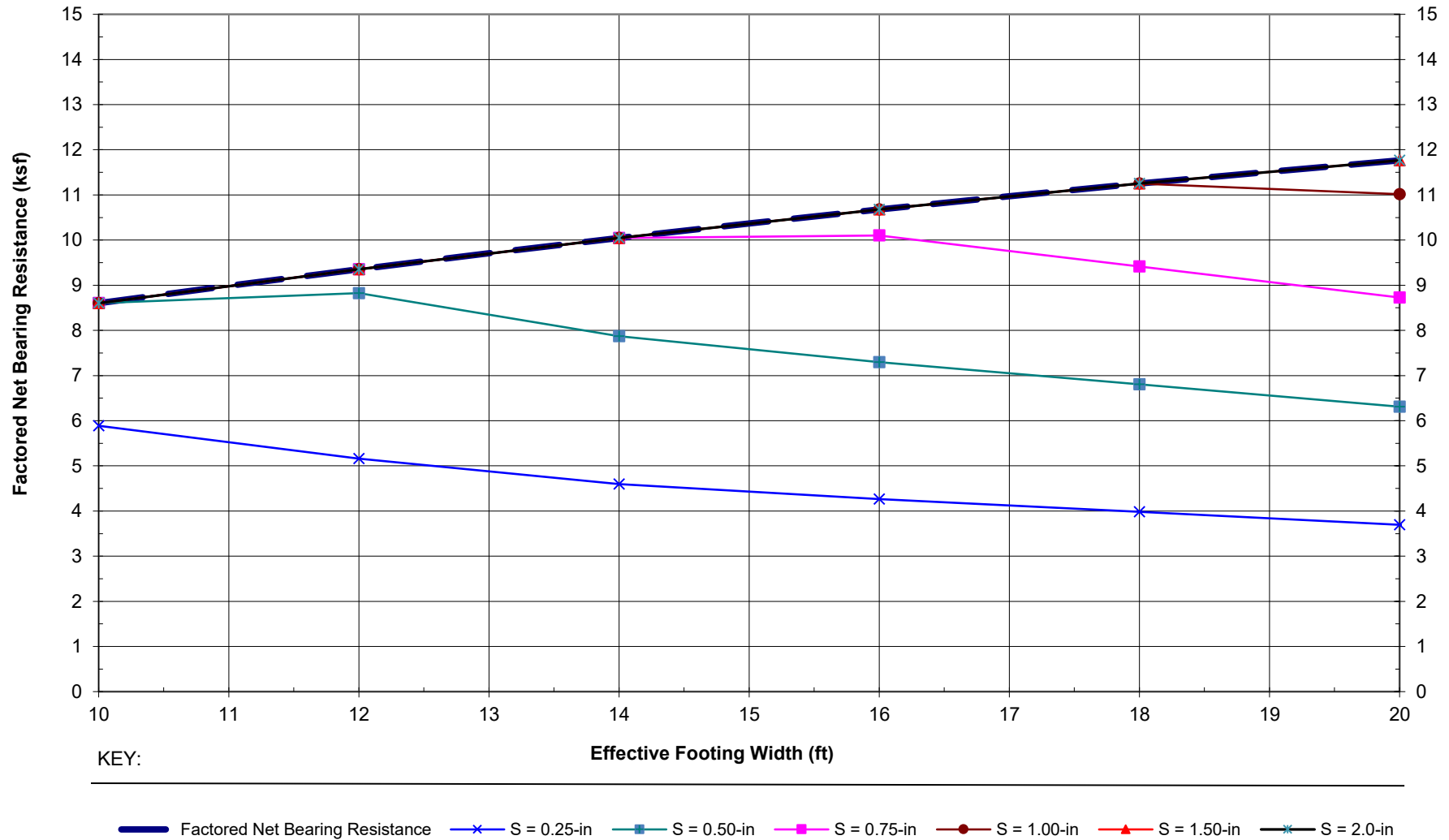


Figure C-2b: Bearing Resistance Chart, Abutment 1 Wing Wall 1, Florida Canyon Wash Bridge Replacement
Effective Footing Length = 24.5 ft; Bearing Elevation at 3658 feet or lower. Depth of embedment $D_f = 5$ ft.
S = Total (Immediate plus long-term) Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
C-2b

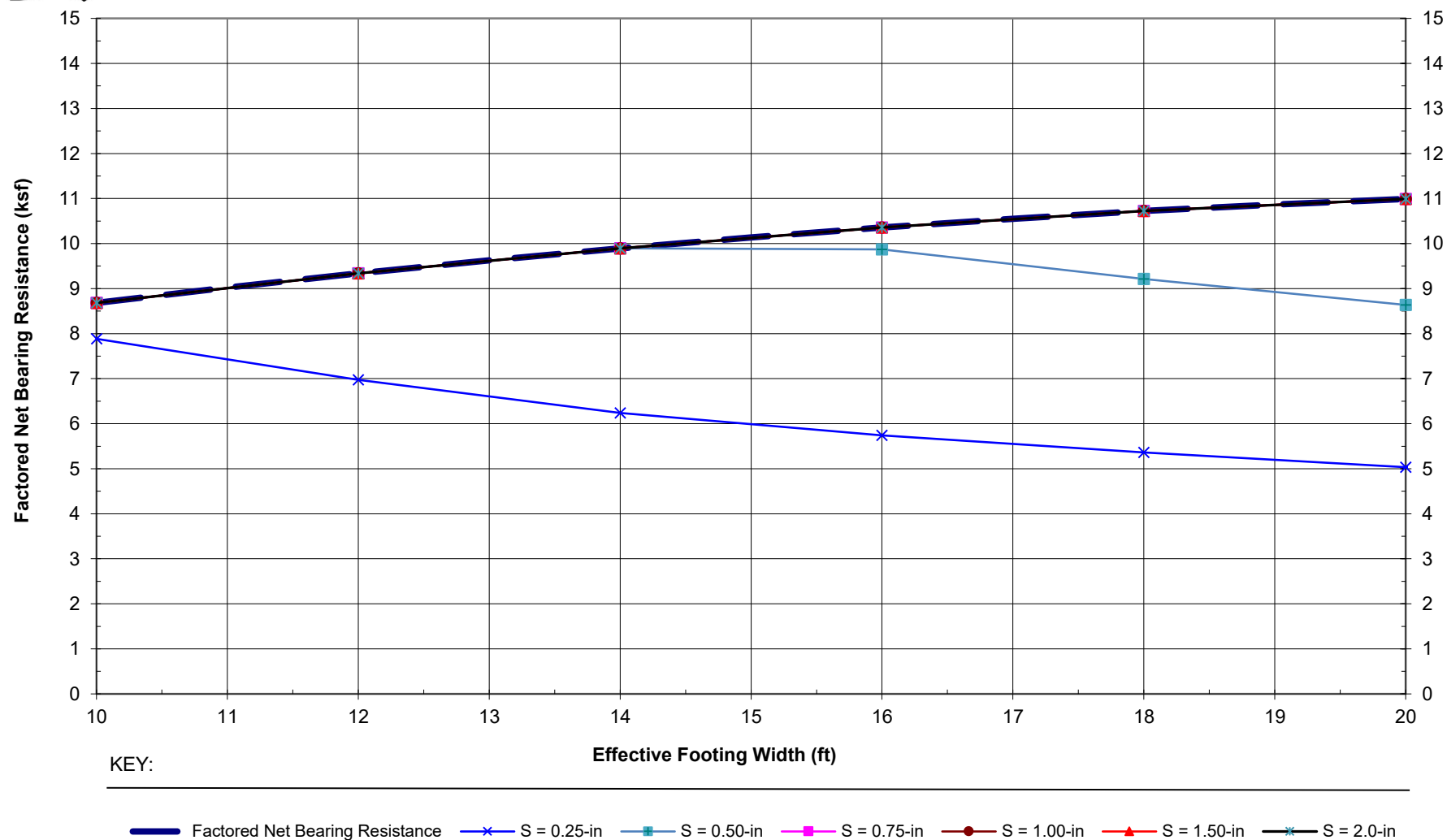


Figure C-3a: Bearing Resistance Chart, Abutment 1 Wing Wall 2 Bottom Step, Florida Canyon Wash Bridge Replacement
Effective Footing Length = 15 ft; Bearing Elevation at 3658 feet or lower. Depth of embedment Df = 5 ft.
S = Immediate Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
C-3a

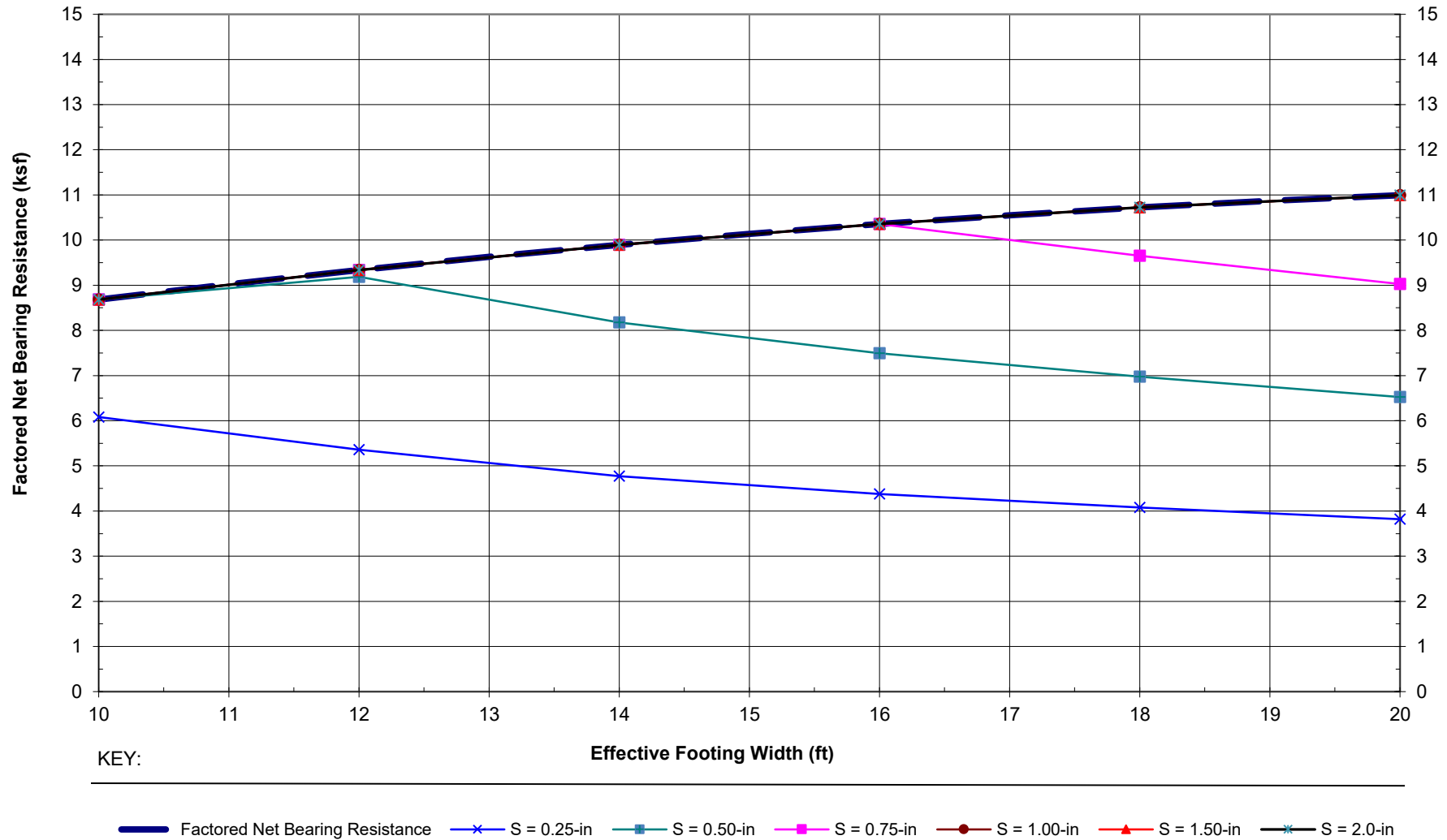


Figure C-3b: Bearing Resistance Chart, Abutment 1 Wing Wall 2 Bottom Step, Florida Canyon Wash Bridge Replacement
Effective Footing Length = 15 ft; Bearing Elevation at 3658 feet or lower. Depth of embedment Df = 5 ft.
S = Total (Immediate plus long-term) Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
C-3b

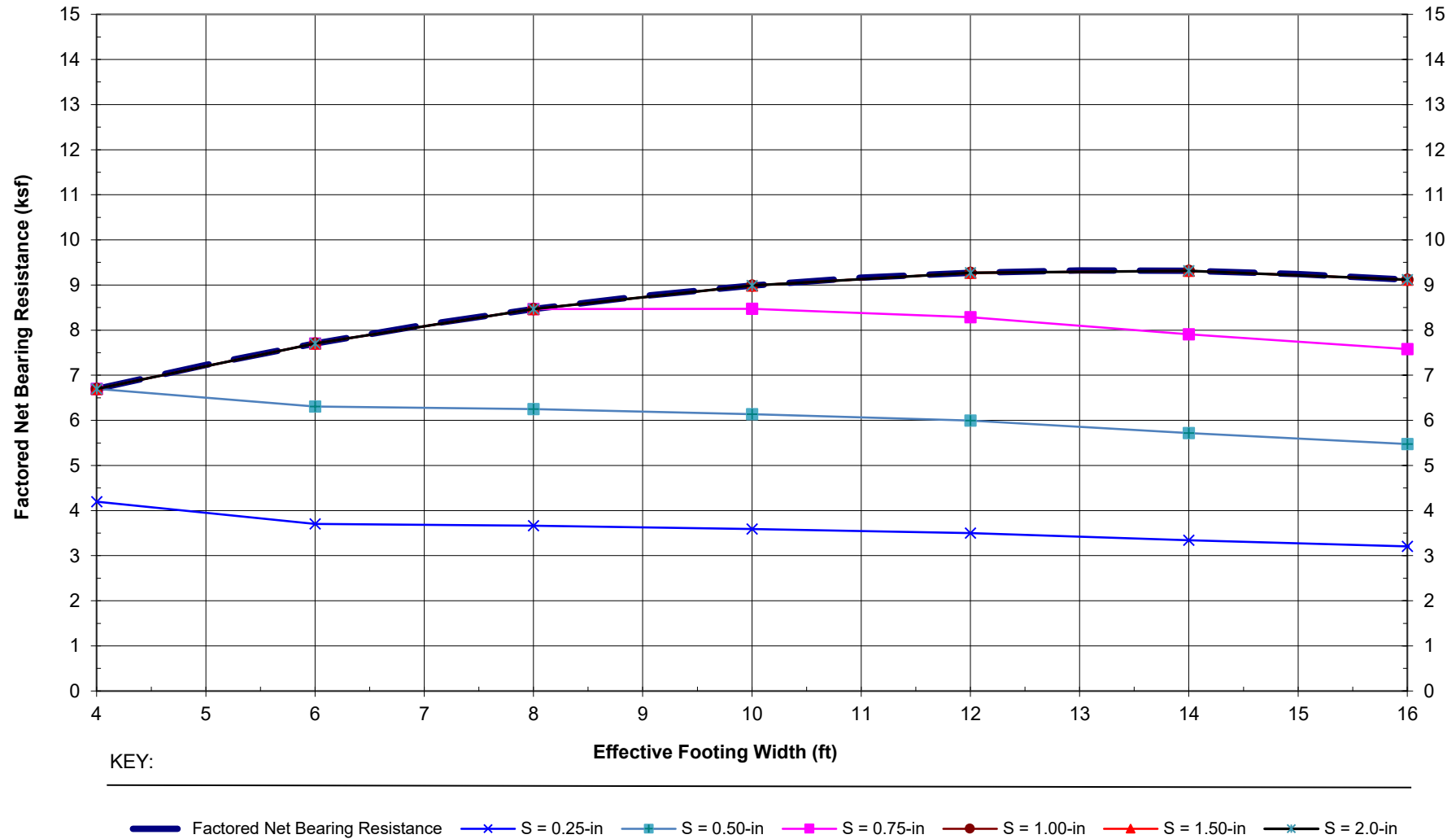


Figure C-4a: Bearing Resistance Chart, Abutment 1 Wing Wall 2 Steps 1 to 3, Florida Canyon Wash Bridge Replacement
Effective Footing Length = 6 ft; Bearing Elevation at 3664 feet or lower. Depth of embedment D_f = 5 ft.
S = Immediate Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
C-4a

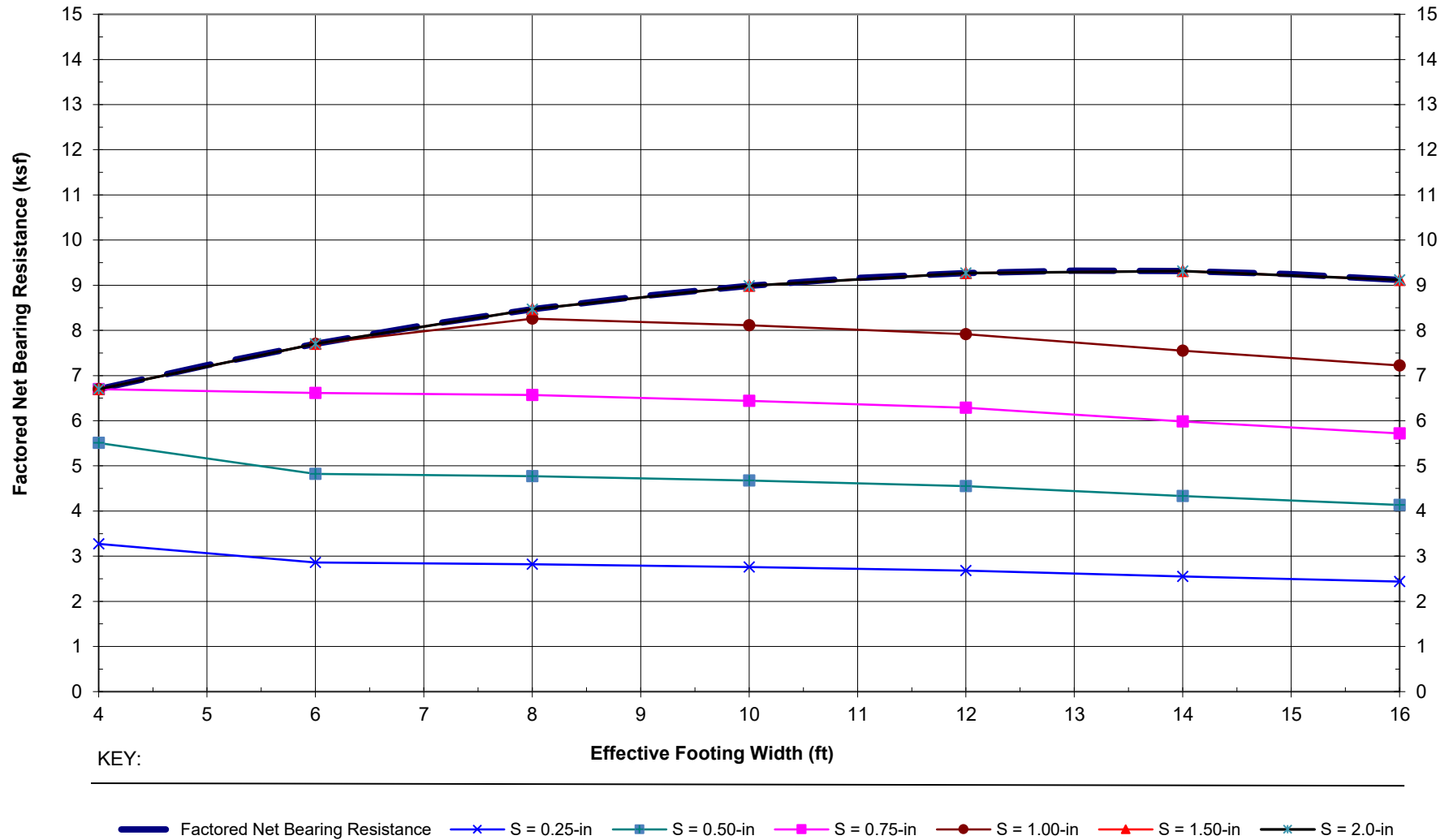


Figure C-4b: Bearing Resistance Chart, Abutment 1 Wing Wall 2 Steps 1 to 3, Florida Canyon Wash Bridge Replacement
Effective Footing Length = 6 ft; Bearing Elevation at 3664 feet or lower. Depth of embedment Df = 5 ft.
S = Total (Immediate plus long-term) Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
C-4b

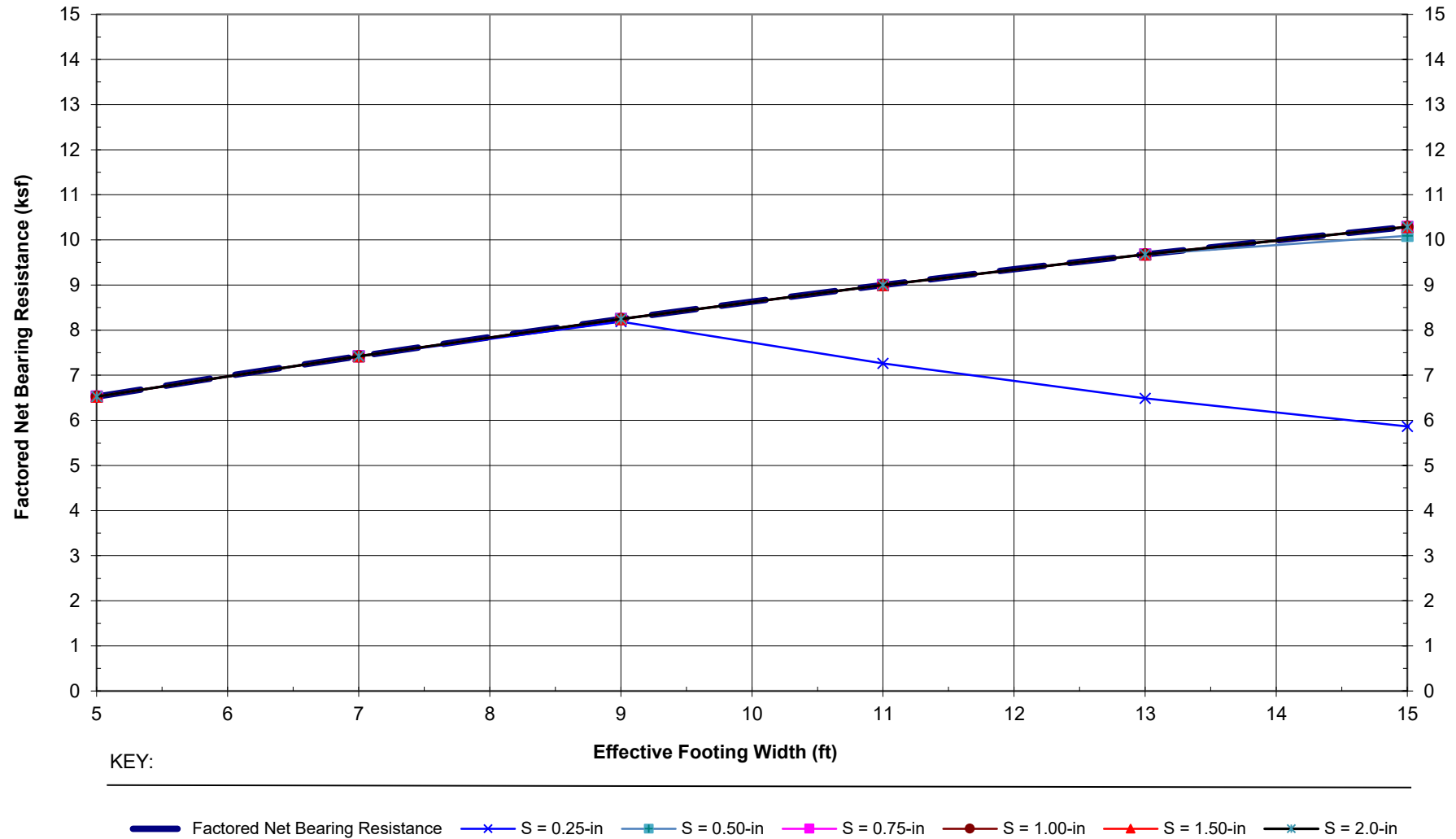


Figure C-5a: Bearing Resistance Chart, Abutment 2 Wing Walls, Florida Canyon Wash Bridge Replacement
Effective Footing Length = 20 ft; Bearing Elevation at 3658 feet or lower. Depth of embedment $D_f = 5$ ft.
S = Immediate Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
C-5a

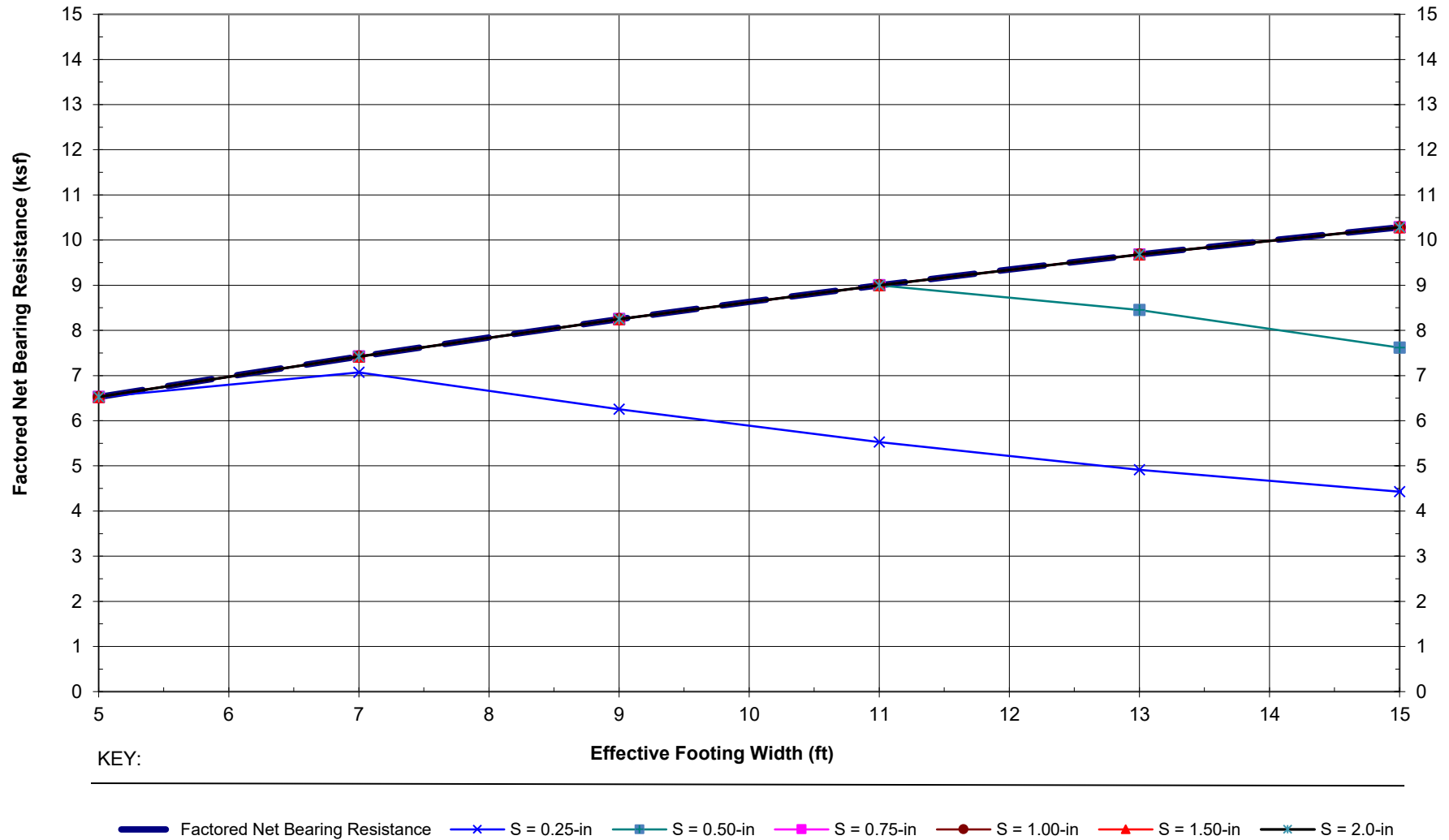


Figure C-5b: Bearing Resistance Chart, Abutment 2 Wing Walls, Florida Canyon Wash Bridge Replacement
Effective Footing Length = 20 ft; Bearing Elevation at 3658 feet or lower. Depth of embedment $D_f = 5$ ft.
 S = Total (Immediate plus long-term) Settlement

Notes: Capacity and settlements presented above are based on $\pm 20\%$ of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
C-5b

APPENDIX D

Spread Footing Design Charts D-1a to D-3b



Madera Canyon Road
Medium Wash Bridge Replacement

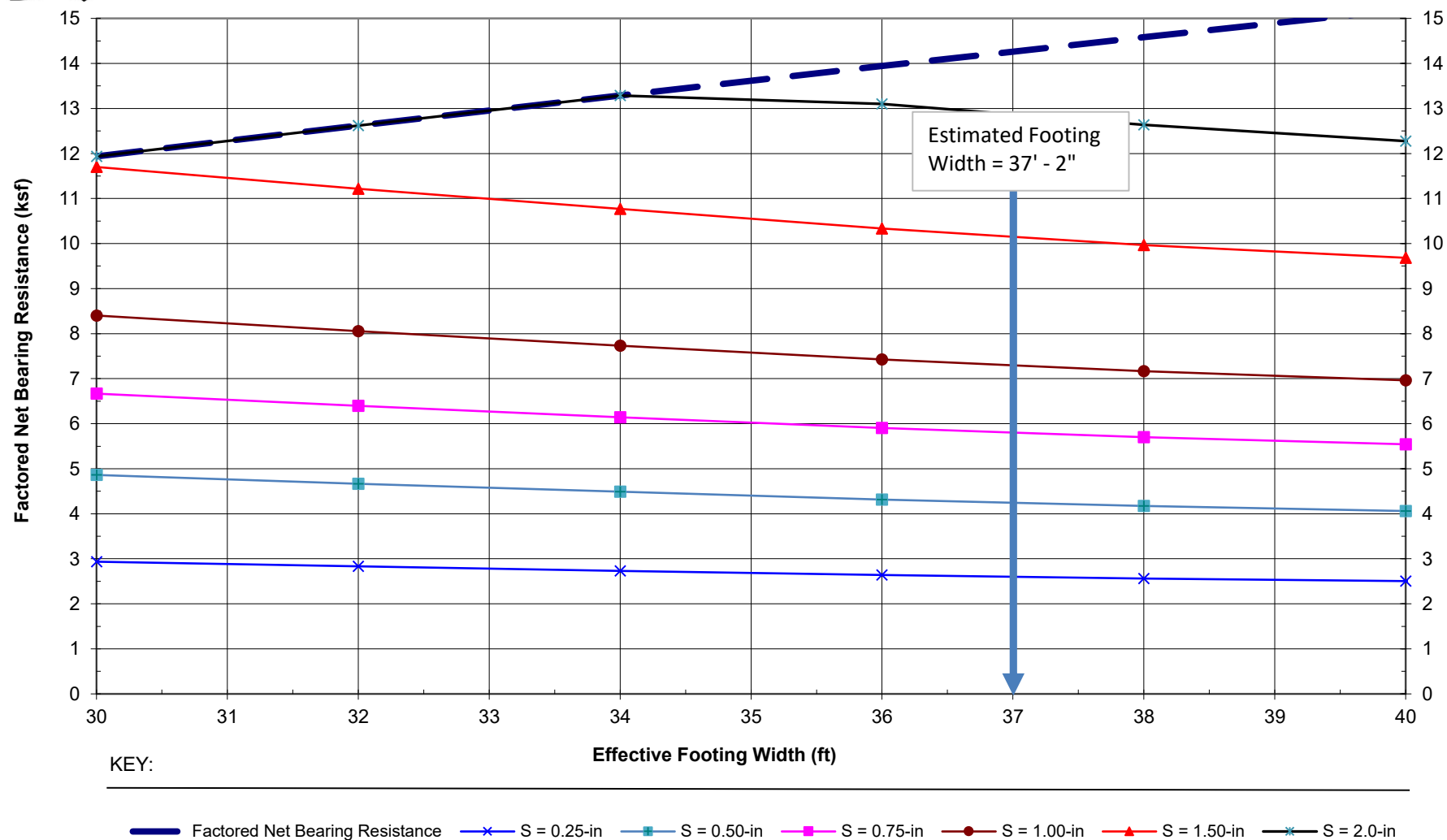


Figure D-1a: Bearing Resistance Chart, Box Culvert Bridge, Medium Wash Bridge Replacement
Effective Footing Length = 102 ft; Bearing Elevation at 3649 feet or lower.
S = Immediate Settlement

Depth of embedment $D_f = 5$ ft.

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
D-1a



Madera Canyon Road
Medium Wash Bridge Replacement

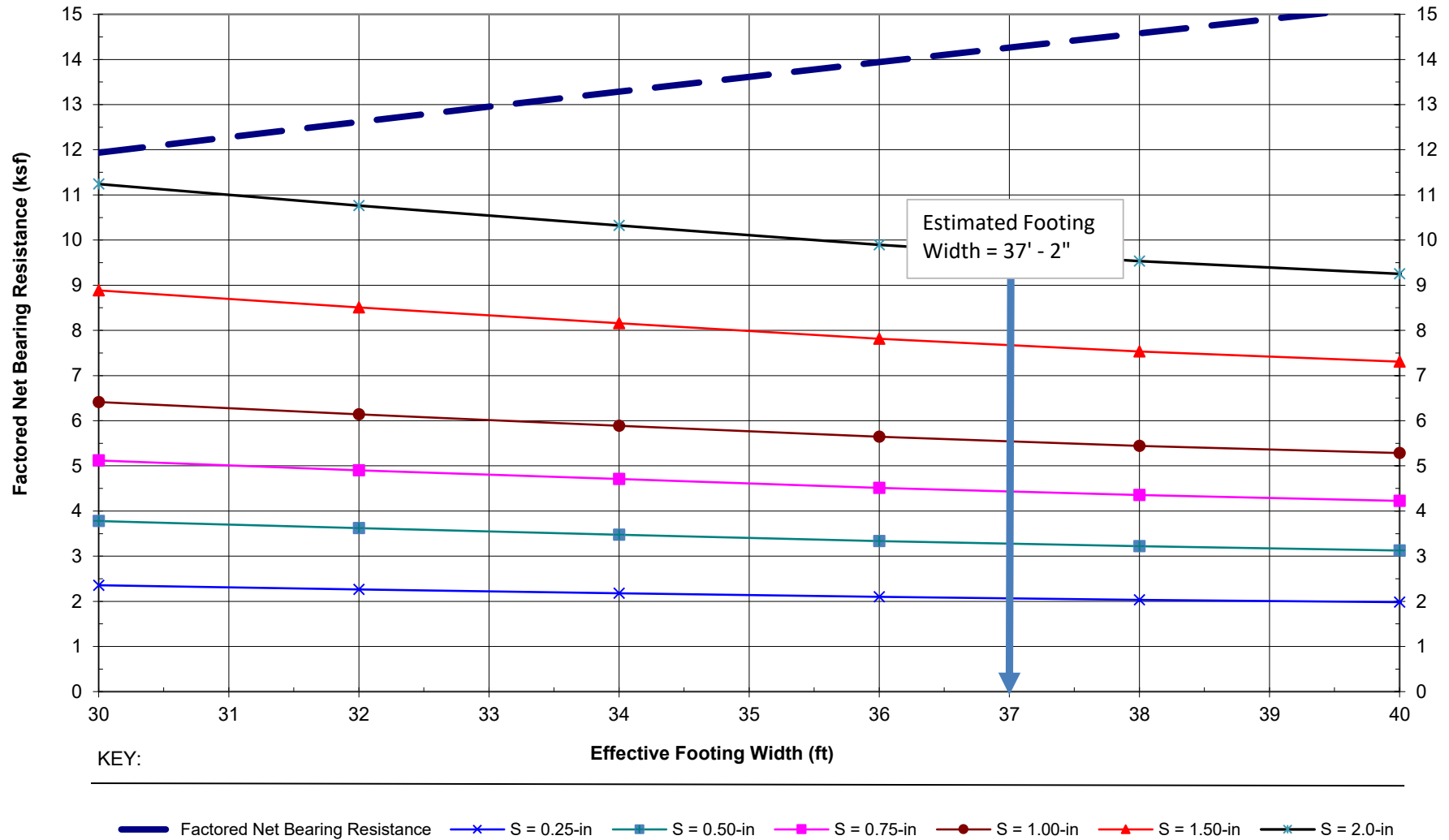


Figure D-1b: Bearing Resistance Chart, Box Culvert Bridge, Medium Wash Bridge Replacement
Effective Footing Length = 102 ft; Bearing Elevation at 3649 feet or lower.
S = Total (Immediate plus long-term) Settlement

Depth of embedment $D_f = 5$ ft.

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
D-1b



Madera Canyon Road
Medium Wash Bridge Replacement

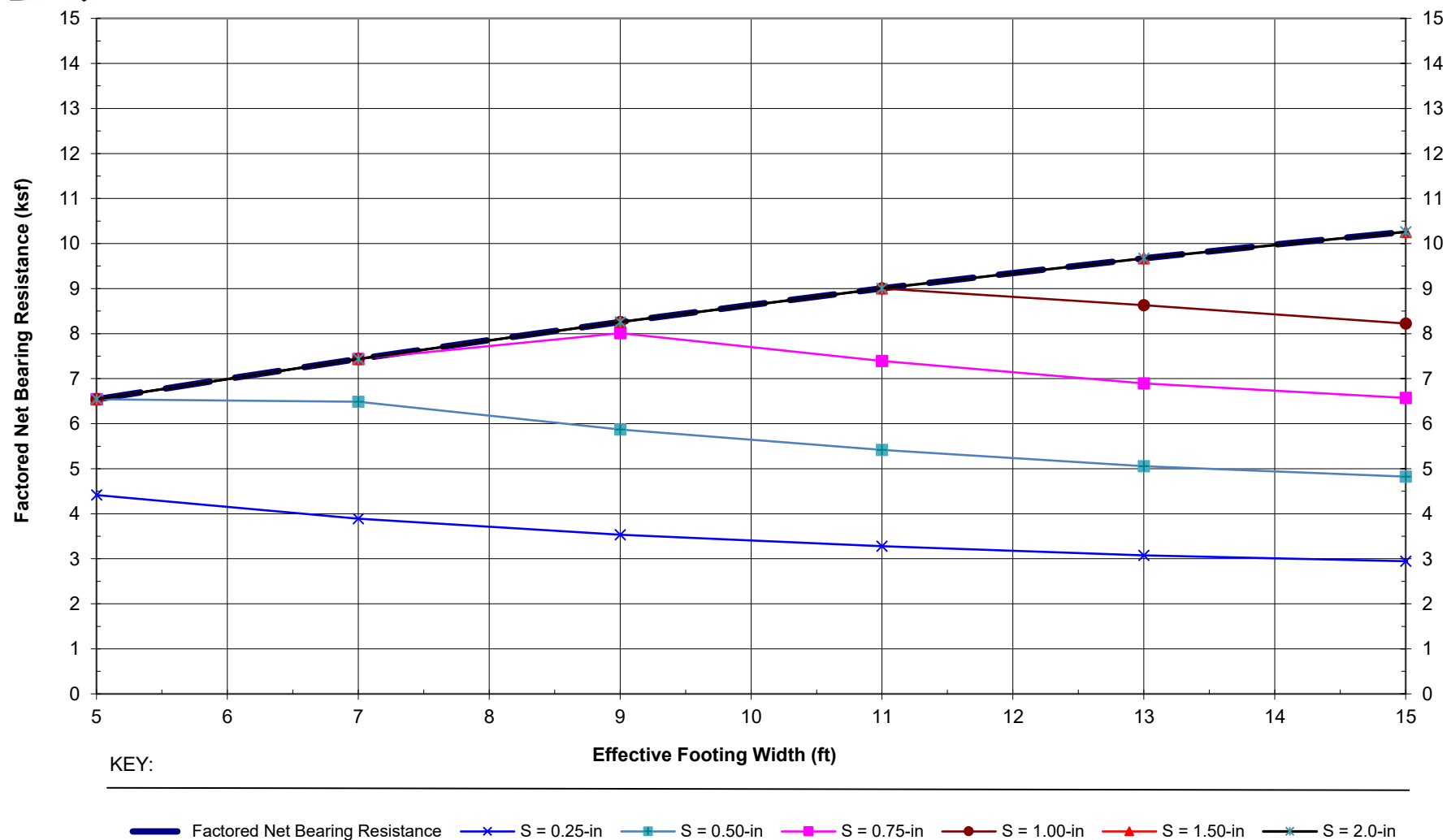


Figure D-2a: Bearing Resistance Chart, Abutment 1 Wing Walls, Medium Wash Bridge Replacement
Effective Footing Length = 19 ft; Bearing Elevation at 3649 feet or lower. Depth of embedment D_f = 5 ft.
S = Immediate Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
D-2a



Madera Canyon Road
Medium Wash Bridge Replacement

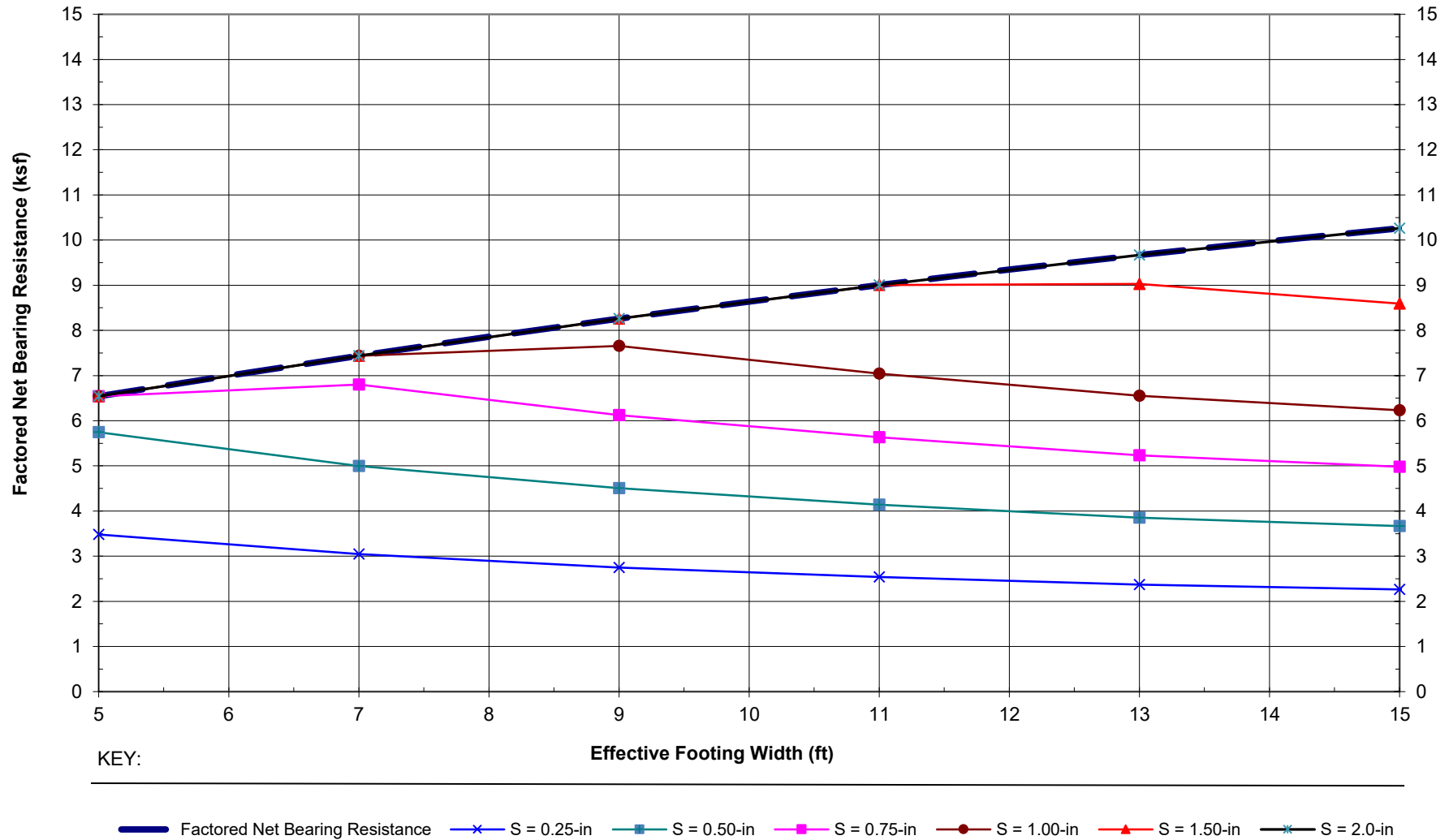


Figure D-2b: Bearing Resistance Chart, Abutment 1 Wing Walls, Medium Wash Bridge Replacement
Effective Footing Length = 19 ft; Bearing Elevation at 3649 feet or lower. Depth of embedment $D_f = 5$ ft.
S = Total (Immediate plus long-term) Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
D-2b



Madera Canyon Road
Medium Wash Bridge Replacement

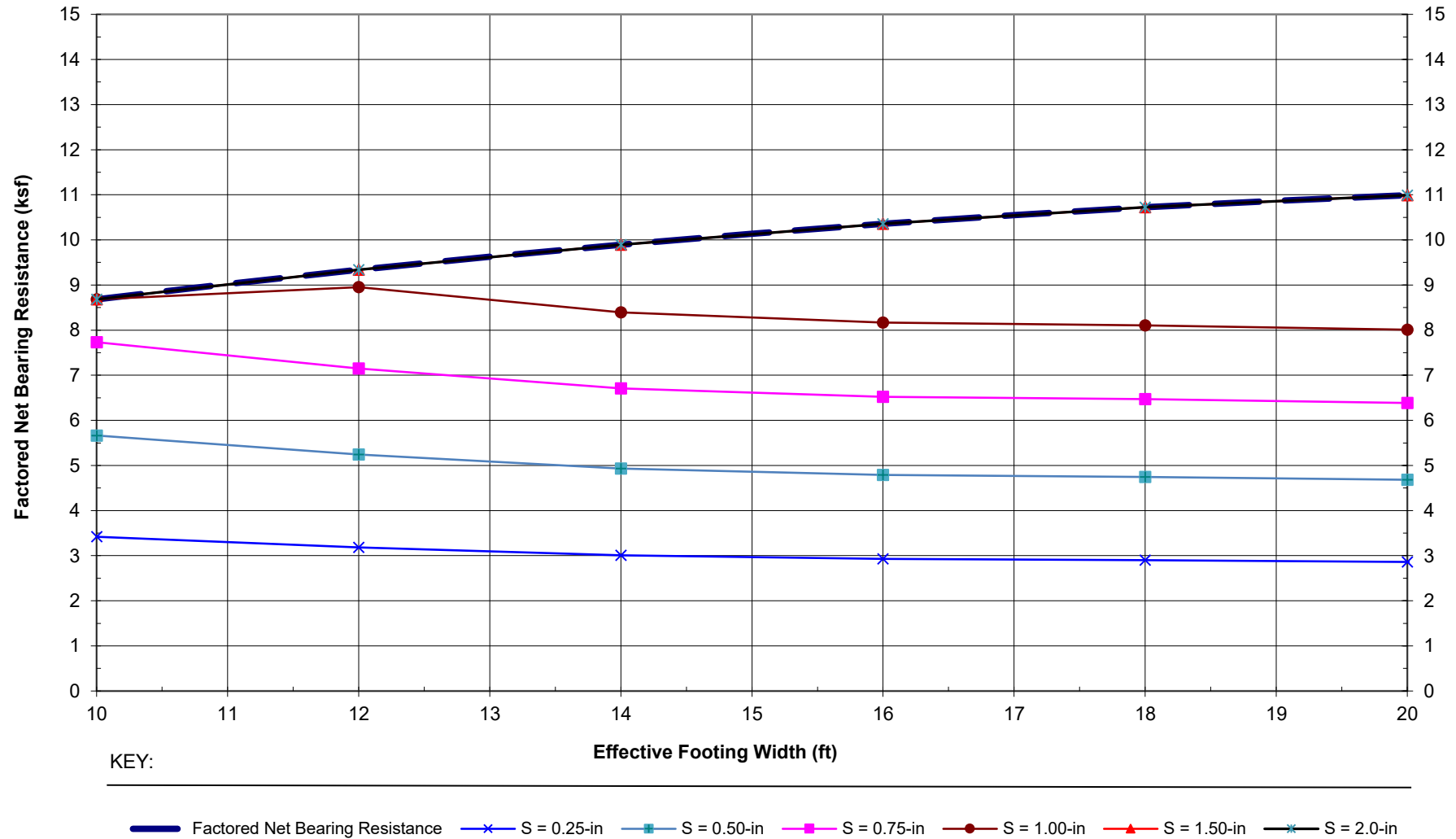


Figure D-3a: Bearing Resistance Chart, Abutment 2 Wing Walls, Medium Wash Bridge Replacement
Effective Footing Length = 15 ft; Bearing Elevation at 3649 feet or lower. Depth of embedment $D_f = 5$ ft.
S = Immediate Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
D-3a



Madera Canyon Road
Medium Wash Bridge Replacement

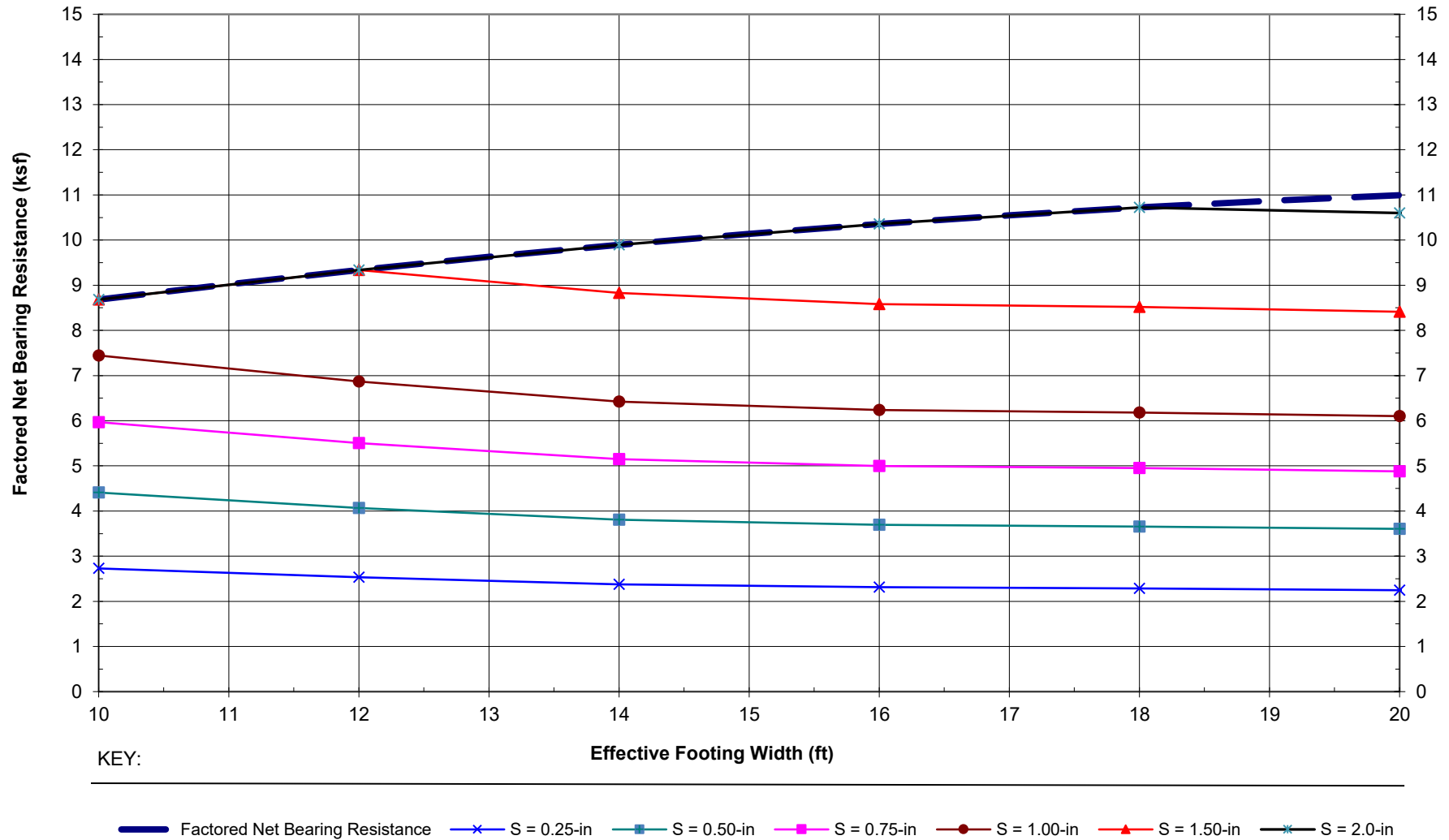


Figure D-3b: Bearing Resistance Chart, Abutment 2 Wing Walls, Medium Wash Bridge Replacement
Effective Footing Length = 15 ft; Bearing Elevation at 3649 feet or lower. Depth of embedment $D_f = 5$ ft.
S = Total (Immediate plus long-term) Settlement

Notes: Capacity and settlements presented above are based on +/-20% of listed dimensions and embedment depth.
Chart incorporates effect of proximity to slope, if applicable.

Figure
D-3b